

**Lake Michigan Potential Damages Study**

**Economic Impact of Lake Michigan  
Levels on Recreational Boating and  
Charter Fishing in Five Counties**

**Final Report**

by  
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# **Economic Impact of Lake Michigan Levels on Recreational Boating and Charter Fishing in Five Counties**

## **INTRODUCTION**

### **Purpose:**

To estimate the potential economic damages related to recreational boating in a five-county study area should Lake Michigan reach extreme, low or high levels.

### **Background and Problem**

The U.S. Army Corps of Engineers is conducting a Lake Michigan Potential Damages Study (LMPDS) to assess potential shoreline damages due to extreme low and high water levels. The study is currently focused on five counties: Ottawa and Allegan counties in Michigan and Ozaukee, Sheboygan and Manitowoc counties in Wisconsin.

Lake Michigan water levels fluctuate over time due to differences in precipitation, temperature and other climatologic factors. In the past 30 years, average monthly levels on Lake Michigan have ranged 6.3 feet. Evidence exists that historic water levels during the time before records were kept may have been much higher and lower than those levels recorded in the past 135 years. In order to consider a full plausible range of water levels, the LMPDS team developed a set of water levels that range over 9 feet from extreme high to extreme low. These levels represent the extreme levels that could plausibly occur over a 50-year time frame. The levels are Stillwater levels, and do not consider storm surge or draw down. While there has been conjecture on the effects of global warming on the Great Lakes, global warming was not factored into the water level projections in this study.

The LMPDS extreme low water level is projected to be 574.3 feet (all water levels in this report are referenced to IGLD 85). For comparison, the record low in July 1964 was 576.7 feet (3.6 feet above the LMPDS extreme low water level). In July 1999, water levels were even higher, at 578.7 feet (4.4 feet above the LMPDS extreme low water level), despite the fact that there were significant recreational boating impacts in that year.

The LMPDS extreme high water level is 583.4 feet. For comparison, the record high water level in July 1986 was 579.5 feet (3.9 feet lower than the LMPDS extreme high water level).

The experience of Lake Michigan recreational boaters during 1999 and 2000 included reduced use of their boats, loss of access to some marina slips, loss of boat launching opportunities at some public ramps and damage to boats that

struck submerged bars or other hazards. In estuaries, large mud flats were exposed. While the level of Lakes Michigan and Huron were lower than that experienced for several decades, the 1999 and 2000 levels were not the lowest experienced during this century and were several feet above a calculated potential extreme low mentioned above. For a discussion of why and how the lake could reach that extreme low or extreme high, see the **Lake Michigan Potential Damages Progress Report on Activities, 1999**, available from the US Army Corps of Engineers, Detroit District office (313) 226-2137 or visit the website, <http://huron.lre.usace.army.mil/coastal/LMPDS>.

This report looks at the effects of both low and high water on recreational boating in five counties on Lake Michigan. However, most of the discussion deals with low water impacts. This is because boats require adequate water to function and low water seems to be more of a limitation than high. Another reason is because during the recent period of low water, boaters and boating industry persons appear unable to perceive high water as a potential problem.

#### *Participants and Relationship to Other Studies*

The Recreational Boating Water Level Damages study was part of the larger Lake Michigan Potential Damages Study (LMPDS) being sponsored by the US Army Corps of Engineers. The project team leader for the recreational boating portion was Planning & Zoning Center, Inc. Team members include Dr. Edward Mahoney and Dr. Daniel Stynes of Michigan State University Department of Park, Recreation and Tourism Resources. Chuck Pistis of MSU Sea Grant Extension and MSU students also participated. Survey work was also designed and supervised by John Cavanagh and Bernie Porn of EPIC MRA, a Lansing-based survey research firm.

LMPDS has been ongoing for about four years. Task 7 of the Potential Damages Study looks at the economic impact of both high and low water levels. High water impacts can occur as a result of accelerated shoreline bluff erosion and flooding of inland areas. Low water impacts include damage to shoreline structures due to exposure; increased costs of dredging for private and public marinas, damage to recreational boats, lost use of marina space and lost income to businesses frequented by boaters. This latter category may include charter-fishing businesses.

LMPDS Task 7 looks at the impacts of bluff erosion on private and public properties, high lake level flooding impacts on private and public properties, low water impacts on water intake and pollution discharge systems and low water impacts on shoreline structures.

The participants in the related Task 7 elements in FY 2000 include consultants DLZ, Inc., Baird and Associates, Planning & Zoning Center, Inc., and John Hoehn, Ph.D., a professor of agricultural economics at Michigan State University.

### *Direct and Indirect Effects of Low Water*

There are both direct and indirect effects of low water. Direct effects include damages to boats, docks and seawalls as a result of a drop in water level. Boats can be damaged as they run aground or ride on the bottom at the dock. The portion of wood docks that were previously underwater and are now exposed to the air can suffer oxidation damage. Seawalls may collapse where water pressure on the front of the wall, if required to resist the force of the earth from behind, disappears with lowered water. An indirect effect is the loss of use of boats by boat owners with the resulting reduction in related spending. Boat slips and launch ramps can become unusable due to low water, forcing boaters to travel to other waters or to cease boating. Reduced boating may also result from the *perception* that low water somehow limits boating opportunity. As a result, fewer persons go boating and therefore spend less money on boating-related activities. In some areas, boating may remain possible but become far more difficult and risky. Shoals and obstructions may become exposed. Some harbors may have to be dredged, a costly process, to permit access for larger boats. It may be possible that, following a lengthy drought, nearly all boat ramps within the study area of the Lake Michigan watershed, both Great Lakes and inland could become unusable. Boater perception of lost opportunity could be based on very real constraints. Boat sales could suffer as a result of low water.

This study looked at the indirect effects of low water by estimating the economic loss of reduced boating opportunity. It also looked at the direct effects of low water by estimating damage to boats and marina dredging. It did not look at the dredging of common harbor areas or damage to structures due to oxidation or other failure. These latter two issues were part of a related study being conducted by others. See below.

This report focuses on loss to the boating industry. In economic studies, it is important to note the difference between an economic loss to a region and financial loss to an economic sector in that region. Persons who choose not to use their boats may spend the same monies intended for boating-related activities on another activity, such as golf. Roughly the same amount of money may be spent on recreation in the region, just not on boating. However, there would be considerable financial impact to those businesses that are wholly or largely related to boating. There could also be a loss to those businesses that enjoy boating trip-related spending where customers come to do their boating from another county.

### *Relationship of Lake Michigan Water Levels to Recreational Boating Economic Sector*

The basic premises of this study were:

- A change in water level would lead to a change in economic activity related to boating.



- Within a range of lake levels that pose no limitations on boating, a certain level of boating activity takes place with a measurable, related level of spending.
- Extreme lake level changes pose limitations on boating activity, and thus affect spending. At extreme high levels, flooding could restrict access to some ramps and marinas and there might be hazardous debris in the water that would pose a risk to boaters. Also, boats in flooded slips could be damaged by riding on top of the dock structures. At extreme low water levels, many boat launch ramps and marinas would not have enough water to provide boat access. Channels may also not be deep enough for boats to gain access to deeper waters from protected harbors.

While the low waters of 1999 and 2000 caused considerable problem for boaters, it was uncertain how much more serious even lower levels would be, such as those of the record 1964 low or the potential low projected by the Corps of Engineers. This study attempted to ascertain the impact.



**Photo 1. Lake Michigan shoreline is beyond the end of the ramp in Wisconsin.**

#### *Study Area*

The LMPDS 2000 study area includes Allegan and Ottawa Counties in Michigan and Manitowoc, Ozaukee and Sheboygan Counties in Wisconsin.

Boat access to Lake Michigan is from drowned river mouth lakes in Michigan: Kalamazoo Lake (Kalamazoo River) in Allegan County and Spring Lake (Grand River), Lake Macatawa and Pigeon Lake in Ottawa County. Access to Lake Michigan in the Wisconsin study area counties is from the Sheboygan River in Sheboygan County, the Manitowoc River and West Twin and East Twin Rivers in Manitowoc County. Shoreline marinas and launch ramps provide access to Lake Michigan in Ozaukee County.

For the purposes of the Recreational Boating study, launch ramps and marinas were studied in counties adjacent to the LMPDS pilot counties. The purpose of this expansion was to estimate the extent of boating opportunity should facilities become unusable in the study area due to low water. Because a large number of boaters trailer their boats to Lake Michigan, they have the flexibility to drive farther than their closest, or favorite boat ramp. These additional counties include Berrien, Van Buren and Muskegon Counties in Michigan and Milwaukee, Kewaunee, Brown and southern Door Counties in Wisconsin.

Access to Lake Michigan in these additional counties is through the drowned river mouth lakes of Muskegon Lake (Muskegon River) and White Lake (White River) in Muskegon County in Michigan. Rivers providing access in the additional Michigan counties include the St. Joseph River in Berrien County and the Black River in Van Buren County. Rivers with access to Lake Michigan in the additional Wisconsin counties include the Milwaukee River in Milwaukee County, the Fox and Suamico Rivers in Brown County and the Kewaunee and Ahnapee Rivers in Kewaunee County.

## **METHOD OF STUDY**

### **Introduction**

This study involved three lines of investigation:

1. The direct losses of marina operators, boat dealers and charter fishing companies were investigated through a survey of those businesses in the pilot counties.
2. Marina operators were asked what their losses would be if Lake Michigan were to continue to decline, or to rise to an extreme level.
3. Owners of registered boats in the parts of the two states most likely to boat in the pilot counties were asked a series of questions about the use of their boat in the study counties, spending related to that use, and whether boating would be impacted if Lake Michigan were to decline or rise in level toward extreme elevations.

Losses to commercial shipping were not investigated because they were beyond the study scope. Also, the cost to dredge public harbors and channels was not investigated in this study. That information was collected as part of another study, the Task 7 Investigation of Potential Low Water Damages.

## Data Sets

The damage estimate in this report was compiled from information derived from multiple component data sets. These components include:

- Existing Boating Days Economic Model. Previous research conducted by the Michigan State University Department of Park, Recreation and Tourism Resources (MSU) established a level of spending associated with a day spent boating. This "Boating Days" model is specific to each county in Michigan. The findings of that study are reported below to illustrate a base level of spending related to recreational boating in the study counties. It was assumed that a similar level of spending occurs in the Wisconsin study counties. A more accurate approach would be to conduct the same type of "Boating Days" study in Wisconsin as was conducted in Michigan. The resources to do that additional economic research were not available, nor were they available to update the study in Michigan in 2000. If low water reduces the number of boating days in a particular county, it is assumed that there would be a reduction in boating-related spending by a proportionate amount. At the beginning of this project, it was assumed that a survey of boaters could establish a direct link between the effect on boating days of a change in water level and changes in spending based on the earlier model. Constraints in the sample size of the survey of boaters and the previous economic studies make a connection too tenuous to use as a basis for a direct estimate.
- Survey of Marina Operators. A survey was conducted by MSU to examine the economic impact of low water on marinas. Owners were surveyed regarding change in slip use, dredging, facility repair or modifications and boat damage repair. (See Appendix A: Marina Survey Form)
- Survey of Charter Boats. Charter boat operators were surveyed by MSU regarding change in business in 2000 compared to previous years and to identify low water impacts. (See Appendix B: Charter Boat Survey Form)
- Survey of Boat Dealers. Boat dealers were surveyed by MSU regarding changes in the sales of boats in 2000 compared to previous years. They were also asked about the affect of low water on sales. (See Appendix C: Dealer Survey Form)
- Survey of Registered Boat Owners. The owners of boats registered in Michigan and Wisconsin were surveyed by the research firm of EPIC MRA by phone to determine their level of use, spending related to boating and their perceptions of water level change and the impact on boating. They were asked about their boating activity in 2000 and whether much lower or much higher levels would impact boating. After consultation with survey researchers it was recognized that boaters would not be able to reliably quantify the change in the number of days they would boat given a large change in Lake Michigan levels. Instead they were asked if those levels would have an affect on boating activity. While boat owners were asked about spending on a variety of boating-related areas, this part of the study was not conducted with as large a sample size as the study in 1994. Therefore, the results should be

considered instructive but not definitive when looking at each county. See Appendix D: Phone Survey Executive Summary).

- Inventory of Boat Launch Ramps. Launch ramps were identified in the study counties and adjacent counties. Each was visited during August 2000 and the depth of water at the end of the ramp established. The purpose of this inventory was to determine the part trailer launched boats would play in the event of extreme low water levels. Previous research by MSU examined the spending of the owners of boats kept on trailers. It was assumed that estimating the potential change in ramp use, some estimate of the effect on spending can be made. Launch ramps in adjacent counties were studied to determine the extent to which boaters could simply relocate from the study counties if low water restricted boating access there. In the 1994 Boating Study, 80% of launchings on Michigan Great Lakes waters were by boats kept at non-waterfront sites. (Stynes, Wu and Mahoney 1998) Most of these launches took place from public or private launch ramps. This appears to have changed to about 55% in 2000 as indicated by the survey by EPIC MRA.

### **Comparison of Recreational Boating Context Between Michigan and Wisconsin**

Both Wisconsin and Michigan are active boating states, with over a million boats owned and actively used in both states. Boaters in both states have choices between thousands of inland lakes and the Great Lakes, so boats registered in both states are of a wide range in size. However, inland lake boating is generally of a different scale and larger boats are usually, but not always, used on Lake Michigan than on inland lakes. We know from past studies in Michigan that larger boats, such as those used on the Great Lakes, are used more days in a boating season than smaller boats. (Stynes, Wu and Mahoney, 1998) This may also be true in Wisconsin. However, there have been no studies to determine this.

There are some differences between the states regarding recreational boating. Michigan, with a larger size, larger population and longer Great Lakes coastline, has a greater number of boats. The Michigan side of Lake Michigan is considered a higher energy coast, so all the boat access sites are within protected harbors or drowned river mouths (connected lakes). The exceptions are within protected bays such as Grand Traverse Bay. On the Wisconsin side there are boat ramps directly on the Lake Michigan shore. Some of these are on the beach while others are protected by breakwaters. There are also ramps on rivers that flow into the lake. There are no drowned river mouth lakes connecting to Lake Michigan on the Wisconsin side. In Michigan, there are many residential properties along the connected lakes where boats are moored. Boats kept at such locations are typically small, but they do have access to Lake Michigan. The connecting rivers in Wisconsin have some residential development along their shores but much of the river-side land near Lake Michigan is industrial or commercial with a few scattered parks. On several Wisconsin rivers, docks for recreational boats line the riverbank in commercial and industrial districts.





**Photo 2. Slips line the Sheboygan River in Sheboygan, Wisconsin commercial/industrial district.**



**Photo 3. Closed launch ramp on Spring Lake, Ottawa County, Michigan.**

## BOATER SPENDING

### Introduction

Boating is big business in the Great Lakes states. In Michigan, the only state for which economic data has been collected on a rigorous, long-term basis, boat owners spent \$418 million in 1994 on equipment, repairs, slip rental, insurance, storage and fuel. (Stynes, Wu and Mahoney 1998) Researchers have found that boaters spend about the same again for trip-related expenses, such as groceries, souvenirs and restaurant visits as for boat expenses. This would mean another approximately \$420 million boating trip related items, for a total spending of over \$800 million in 1994. The boating-related economy was likely higher in 2000.

Great Lakes boating is an important segment of the overall Michigan boating economy and probably of the Wisconsin boating economy as well. There is very little data available on boating in Wisconsin so this study uses Michigan as an example of the impact of Great Lakes boating. Of the 13.4 million boating days estimated for 1994, 4.8 million were on Great Lakes waters. Out of 3.9 million launches at access sites, 1.4 million were at sites with access to the Great Lakes. The use of larger boats stored at Great Lakes marinas accounted for a third of boat-related spending, or between \$200 million and \$300 million in Michigan in 1994.

The LMPDS study area is not within the region of highest boating use in Michigan but boat use was still significant. The West Central and Southwest regions (which include the two LMPDS pilot counties of Allegan and Ottawa) accounted for about 585,000 boating days out of a total Michigan 4,843,000 boating use days in 1994. Southeast Michigan experienced higher levels of boating use.

This study looked at boater spending over a period of about six years in order to make conclusions about recent spending and provide conjecture about future spending. Most of the data was collected by Michigan State University, Department of Park, Recreation and Tourism Resources beginning in 1994. That work focused entirely on Michigan. In 2000, EPIC MRA included questions on boater spending in its survey of registered boat owners in both Michigan and Wisconsin. The 1994 MSU study was more comprehensive and surveyed a larger sample in order to make county-specific observations. The EPIC MRA survey used a smaller sample due to cost constraints, but the results were used to make some important general observations about spending.

Information presented below on boater spending has been divided into spending directly related to keeping a boat and that related to trips using the boat. Then both pieces of information were combined to look at total spending. Direct boat-keeping expenses include equipment, repair and maintenance, seasonal slip rental, put-in and haul-out fees, off-season storage, fuel and boat insurance. Trip-

related spending includes groceries, restaurant meals, souvenirs and similar expenses.

### Key Study Questions

Key to this discussion are the questions:

- How much did boaters spend per day on boating?
- How many days less did they boat in 2000 compared to years in which water levels were not limiting?
- How many days less would they boat if water levels go much lower?

The answer to the first question is not too difficult and the discussion follows below. The answers to the second and third parts are not easy to answer. Part of the difficulty is that in 2000 many boaters reported boating less, due in part to low water, but the number of days they reported boating was greater than that found in previous surveys during periods of higher water.

### Spending Patterns

**The figures we've developed suggest that annual craft-related spending is about \$600 annually and boating trip-related spending about \$35 per day.**

These figures may be conservative but are useful in establishing the potential level of spending. Those amounts are averaged across all boats and all counties (in Michigan). The details of this spending is discussed in more detail below. As can be seen from the discussion, it would be possible to partition the analysis by boat size, because boat spending is different for different size boats. We also know how many boats of different sizes are registered in each of the counties. However, that would also require a number of assumptions about where boats are kept and owner behavior that we are not prepared to defend.

A 1994 survey (Stynes, Wu and Mahoney, 1996) identified spending patterns for equipment, repair and maintenance, seasonal slip rental, put-in and haul-out fees, off-season storage, fuel and boat insurance. Boater spending on the watercraft (in 1994) ranged from an average of \$205 per boat less than 16' in length per year to about \$4,445 per boat per year for boats greater than 29' long kept in Great Lakes marinas. The average for all boats was about \$753 annually. These figures are for repairs, slip and launching fees, fuel and insurance. (Stynes, Wu and Mahoney, 1996)

A 1998 survey found slightly varied spending for boat equipment, slip rental and related expenses. The range for craft-related spending was from \$160 for boats <16' to \$430 for personal watercraft (not a separate category in 1994) to \$5,039 for boats 29' and over. The higher spending in 1994 on craft <16' may be accounted for by inclusion of personal watercraft at that time. As shown in the 1998 results, spending on personal watercraft is slightly higher for its length class.

In the EPIC MRA survey in 2000, average spending per season for fuel, dock fees and maintenance was about \$614. This was averaged across Michigan and Wisconsin although the questions were directed at boating in the study counties. This was identical to the results of the 1998 study by MSU.

Boater spending on trips also contributes financially to local businesses. MSU identified the spending patterns of boaters for day trips and overnight trips. Trip spending in 1998 was about \$23 per day trip and \$68 per overnight trip. Of the \$23 day trip average, nearly \$12 was for tourism-related expenses (restaurant meals and drinks, groceries and take-out food, auto gas and oil, shopping and souvenirs, recreation and entertainment) and the rest for boat expenses (boat fuel, temporary docking, pump-out and launch fees and repair and maintenance). Of the \$68 overnight trip average, nearly \$46 was for tourism-related expenses and the rest for boat expenses.

Boaters tend to spend relatively little on lodging. This is because boaters either spend the night on their boats, or at seasonal homes or the homes of relatives. The boating segment that spends the most on lodging are those with boats but without waterfront homes. MSU found the average spending on lodging is \$10 while for other groups of boaters it is only \$5.

In the 2000 EPIC MRA survey, boaters reported higher trip-related spending. This was \$50 in Michigan and \$64.50 in Wisconsin. The 2000 survey did not distinguish between day trips and overnight trips. The EPIC MRA survey further asked about expenses to travel to go boating. The response was an average \$183 per season in Michigan and \$189 in Wisconsin.

Boaters that keep their watercraft at marinas and the owners of large boats (> 20') more than make up for their low spending on lodging through slip fees or by buying large amounts of fuel for their boats. While the weighted average spending for fuel for boats of all lengths is \$9.34 per trip, spending for fuel for boats 21' to 28' averages \$17.24 and \$30.03 per trip for boats 29' and greater. Total trip spending for boats kept at marinas averaged \$71.43 for day trips and \$110.15 for overnight trips in 1998. (Stynes et al, 1998) Total day trip spending in 1998 for larger boats was \$55.95 for boats 21' to 28' and \$91.14 for boats 29' or larger. Average trip spending for all boats was \$34.56 in 1998.

Regarding the personal expense of groceries and take-out food, trips with larger boats again count for more spending, with the exception of personal watercraft. Trips with boats 21' to 28' average over \$10 per day for groceries and take-out food. Boats 29' or larger account for a little over \$11 per day on average for the same category of spending. Persons using personal watercraft spend nearly \$13 on average for each day of a boating trip.

Spending on personal expenses on larger boats may be greater because they can accommodate more people. The exception is personal watercraft. Here it



may be the exercise on the water that improves appetites and spending on food, but it could also be that many people accompany a personal watercraft, waiting on shore for their turn to ride.

**An MSU survey in 1994 showed that boaters went boating an average of between 7 and 14 days per year on Great Lakes waters in the Michigan pilot counties and those immediately adjacent. See Table 1. The EPIC MRA survey in 2000 showed average days of boating in Great Lakes waters to be about 23 in the Wisconsin counties and 26 in Michigan.** In 1994, Lake Michigan averaged about 2 feet higher than in 2000. Later in the discussion we estimate potential boater spending at both ranges of boater days.

There were 9,668 boats registered in 1994 in Allegan County and 19,719 in Ottawa County. (Stynes, Wu and Mahoney, 1996) In 2000, there were 16,239 boats registered in Allegan County and 31,472 in Ottawa County. (Michigan Secretary of State) In 2000 there were 6,400 boats registered in Ozaukee County, 7,962 in Manitowoc County and 9,660 in Sheboygan County. (Wisconsin Department of Natural Resources) Earlier figures were not obtained for Wisconsin. The Michigan figures show a large increase in boat registration for Allegan and Ottawa Counties. It should be noted that in Michigan, not all boats registered in a particular county are kept in that county. They may be kept in an adjacent county or at a second home or marina some distance away. Wisconsin records the county where the boat is kept in its boat registration database.

Boat-related spending varied depending on the size of the boats and where they were *kept*. In the study counties of Allegan and Ottawa, there were 7,221 and 14,855 boats, respectively kept in those counties in 1994. The highest spending occurred with the larger boats kept at marinas with Great Lakes access. While there are a greater number of boats registered in these two counties in 2000, it is uncertain how many boats were *kept* there. The proportion of boats registered to boats kept may have been different in the 2000 season of low water.

The tables that follow explore potential spending by boaters in the pilot counties. It is important to note that this is only an estimate of how much could be spent on boating if all boat owners went boating. It also relies on the accuracy of the information supplied by survey respondents. Boat owners, among other recreational survey respondents tend to "telescope." It means that in response to questions about a favorite activity, they extend their real experience into greater, imagined or hoped-for waters. They exaggerate. One of the things they may exaggerate is how much they use their boats.

In 1994, boater spending *on the craft itself* in the two Michigan pilot counties was about \$20.6 million. This figure was based on all boating. See Table 1. A comparison with adjacent counties can be seen in the table. Boat craft spending was \$5.29 million in Allegan County and \$15.38 million in Ottawa County.

**Table 1. Boating Craft Spending by Michigan County, 1994**

<b>County</b>	<b>Boats Kept in the County</b>	<b>Boat Operating Expenses and Fuel Purchases</b>
<b><i>Allegan</i></b>	<b><i>7,221</i></b>	<b><i>\$5,290,000</i></b>
<b><i>Ottawa</i></b>	<b><i>14,855</i></b>	<b><i>\$15,380,000</i></b>
<b><i>Sub Total</i></b>	<b><i>22,076</i></b>	<b><i>\$20,670,000</i></b>
Berrien	10,514	\$9,660,000
Van Buren	6,114	\$4,640,000
Muskegon	9,919	\$11,140,000
<b><i>Sub Total</i></b>	<b><i>26,547</i></b>	<b><i>\$25,440,000</i></b>
<b>Total Five Counties</b>	<b>48,623</b>	<b>\$46,110,000</b>

*Source: Stynes, Wu and Mahoney, 1996. Note: This research was not done in Wisconsin.*

Boaters spent an estimated nearly quarter of a million days boating on Lake Michigan and connecting waters in Allegan and Ottawa Counties in 1994. The number of boating days was estimated to be over a half a million in the five-county western Michigan region in 1994.

**Table 2. Boating Craft Use on Great Lakes by Michigan County, 1994**

<b>County</b>	<b>Boats Kept in the County</b>	<b>Boat days of Use on Great Lakes</b>	<b>Average days of Great Lakes Use</b>
<b><i>Allegan</i></b>	<b><i>7,221</i></b>	<b><i>53,920</i></b>	<b><i>7</i></b>
<b><i>Ottawa</i></b>	<b><i>14,855</i></b>	<b><i>188,700</i></b>	<b><i>13</i></b>
<b><i>Sub Total</i></b>	<b><i>22,076</i></b>	<b><i>242,620</i></b>	
Berrien	10,514	97,540	9
Van Buren	6,114	46,710	8
Muskegon	9,919	134,850	14
<b><i>Sub Total</i></b>	<b><i>26,547</i></b>	<b><i>279,100</i></b>	
<b>Total Five Counties</b>	<b>48,623</b>	<b>521,720</b>	

Source: Stynes, Wu and Mahoney, 1996. Note: This research was not done in Wisconsin.

In Table 2, the average number of days of use per boat was derived by dividing boating days by the number of boats in each county.

If we assume that Wisconsin boats were used on Lake Michigan a similar amount to Michigan use, the number of boating days could be estimated at just over 200,000 for the three-county pilot area and over three-quarters of a million if the adjacent counties are included. We assumed that the Berrien County most closely related to Wisconsin because of the lack of drowned river-mouth lakes and high-volume boat launch facilities in Berrien County and the Wisconsin counties. Table 3 estimates the number of boat days on Lake Michigan in Wisconsin counties based on the Berrien County, Michigan figure of 9 days per boat and the number of registered boats in each county. The table includes counties adjacent to the three study counties.

**Table 3. Estimated Great Lake Use of Boats in Wisconsin Counties in 1994**

County	Registered Boats Kept in the County	Assumed Average Days of Great Lakes Use	Boat days of Use on Great Lakes
<b>Manitowoc</b>	<b>7,994</b>	<b>9</b>	<b>71,946</b>
<b>Ozaukee</b>	<b>5,568</b>	<b>9</b>	<b>50,112</b>
<b>Sheboygan</b>	<b>9,725</b>	<b>9</b>	<b>87,525</b>
<i>Three County Sub Total</i>	23,287		209,583
Milwaukee	32,849	9	295,641
Kewaunee	1,992	9	17,928
Door	6,356	9	57,204
Brown	21,785	9	196,065
Seven County Total	86,269		776,421

Source: Wisconsin Department of Natural Resources with data interpreted by Planning & Zoning Center, Inc. based on Stynes, Wu and Mahoney, 1996.

The EPIC MRA survey completed in 2000 estimates that boaters spent on average, 26 days in Michigan and 23 days in Wisconsin in 2000 engaged in boating on Lake Michigan or connecting waters. This information is not specific to an individual county. These figures are slightly smaller from those reported by EPIC MRA in their executive summary in the Appendix. In reviewing the data we found reports of extreme numbers of days of boating use and eliminated the outlying figures in a recalculation.

#### *Boat Size*

We assumed for this study that only boats 16' or longer would be used on Great Lakes waters. The registration lists for both states included boats as short as 5'. In fact, more than half the registered boats were less than 16'. However, in trying to estimate spending, we only looked at the number of boats that would use Great Lakes waters. It is likely that smaller boats will use the Great Lakes, especially personal watercraft. However, their use might be limited compared to that of larger boats and we know from past studies that spending related to smaller boats is much less.

Table 4 shows the number of boats in each county we assumed would be used on Great Lakes waters.

**Table 4. Boats 16' or Greater in Five Pilot Counties in 2000**

County	Total Registered Boats	Boats 16' or Longer Kept in the County
<i>Allegan</i>	<b>16,239</b>	<b>6,187</b>
<i>Ottawa</i>	<b>31,472</b>	<b>13,367</b>
<i>Manitowoc</i>	<b>7,962</b>	<b>3,220</b>
<i>Ozaukee</i>	<b>6,400</b>	<b>2,499</b>
<i>Sheboygan</i>	<b>9,660</b>	<b>4,010</b>
<b>Total</b>	<b>71,733</b>	<b>29,283</b>

*Source: Wisconsin Department of Natural Resources and Michigan Secretary of State*

If one assumes that boats 16' and longer are suitable for use on Lake Michigan (at least in good weather), then there are potentially just under 30,000 boats in the five pilot counties.

We estimated the number of boats in each county that could be launched from a trailer on each boating trip. This was done in two ways, with different results. One was to count the number of boats registered in each county that are 24' or under. To be consistent with other calculations in this report, we also counted only boats 16' or longer as being those most likely to use Great Lakes waters. According to that method, the total number of boats 16' to 24' in the five pilot counties was nearly 26,000 (Michigan and Wisconsin Boat Registration Lists). Second, we used the percentage of EPIC MRA survey respondents who said they launched from a boat launch, which would result in about 13,000. (See Appendix D) One could argue that the latter figure of 13,000 may be a better estimate of how many were actually launched compared to how many could be launched. However, to estimate potential spending we will use the larger figure. This takes into account the possibility of better weather and lower fuel prices that could increase the percentage of boats used.

We can roughly estimate spending in Wisconsin counties based on the number of boats kept in each county and average spending in Michigan counties. We will assume the average daily spending in Michigan counties is the same in Wisconsin. It probably is not the same, especially not in each county, but we do not have the survey data to provide more accurate information. This may come in future studies.

### **Potential \$29 Million to \$43 Million in Spending**

**We roughly estimate that potential Great Lakes boating-related spending in the five pilot counties could have reached \$29 million to \$43 million dollars in 2000.** The wide range is due to widely different estimates of the number of days of Great Lakes boating per boat registered in those counties. See Table 5. This is spending on boating-related trips and on the craft itself (maintenance, insurance, slip space, launching fees, etc.)

The nearly \$30 million or even higher is the boater spending that is at risk if the level of Lake Michigan drops further. We are not able to estimate how much that spending would drop at the various lake levels. However, the proportion would be dramatic. At the extreme low level considered by the Corps of Engineers, most marinas in Michigan report they would be out of business. See discussion that follows. There would be few if any boat launches available for Lake Michigan access. See discussion that follows. A very large proportion of Great Lakes boating would be gone.

It is likely that that money would be spent on other things and recreational activities, but the boating-related businesses in the five pilot counties would see a severe decline in business.

There would be some residual business for the storage of boats and people who also have smaller boats would use them elsewhere if possible.

**Table 5. Potential Recreational Boat-Related Spending in Five Lake Michigan Counties: Two Results Based on 1994 and 2000 Surveys of Number of Boating Days**

Spending estimate based on 23 and 26 average boating days from EPIC MRA 2000 survey

State/ County	Estimated Number of Boats Used on Great Lakes Waters	Average Days of Use from EPIC-MRA 2000 Survey	Estimate of Boating Days per County	Boating- Related Trip Spending per County @\$35	Seasonal Expenses per County @\$614	Potential Total Spending Year 2000
Michigan						
Allegan	6,187	26	160,862	\$5,630,170	\$3,798,818	\$9,428,988
Ottawa	13,367	26	347,542	\$12,163,970	\$8,207,338	\$20,371,308
Wisconsin						
Manitowoc	3,220	23	74,060	\$2,592,100	\$1,977,080	\$4,569,180
Ozaukee	2,499	23	57,477	\$2,011,695	\$1,534,386	\$3,546,081
Sheboygan	4,010	23	92,230	\$3,228,050	\$2,462,140	\$5,690,190
<b>Total</b>	<b>29,283</b>		<b>732,171</b>	<b>\$25,625,985</b>	<b>\$17,979,762</b>	<b>\$43,605,747</b>

Spending estimate based on 7, 9 and 14 average boating days interpreted from MSU 1994 survey

State/ County	Estimated Number of Boats Used on Great Lakes Waters	Average Days of Use from MSU 1994 Survey	Estimate of Boating Days per County	Boating- Related Trip Spending per County @\$35	Seasonal Expenses per County @\$614	Potential Total Spending Year 2000
Michigan						
Allegan	6,187	7	43,309	\$1,515,815	\$3,798,818	\$5,314,633
Ottawa	13,367	14	187,138	\$6,549,830	\$8,207,338	\$14,757,168
Wisconsin						
Manitowoc	3,220	9	28,980	\$1,014,300	\$1,977,080	\$2,991,380
Ozaukee	2,499	9	22,491	\$787,185	\$1,534,386	\$2,321,571
Sheboygan	4,010	9	36,090	\$1,263,150	\$2,462,140	\$3,725,290
<b>Total</b>	<b>29,283</b>		<b>318,008</b>	<b>\$11,130,280</b>	<b>\$17,979,762</b>	<b>\$29,110,042</b>

Note: Trip-related spending of \$35 per county is rounded from \$34.56.

Boating days estimate of 9 for Wisconsin counties based on average days of Berrien County in Michigan.

Source: 1994 Survey by MSU and 2000 Survey by EPIC-MRA.

The different totals of about \$29 million and about \$44 million are based on the same figures except for estimates of the number of days spent boating per season. The 2000 survey is more recent than the 1994 study but the 1994 survey gathered more county-specific information.

## ECONOMIC IMPACTS OF WATER LEVEL CHANGE

### **Economic Impact of Water Level Change on Marinas**

As Table 4 shows, there are thousands of boats in the study counties that have Great Lakes access. Due to boat size and convenience, many of those are kept at marinas in the Michigan pilot counties. This increases boater spending, primarily for seasonal storage.

#### *Types of Impact of Low Waters on Marinas*

Marinas rely on access to the slips in the facility by boats of varying sizes. Marinas try to provide slips for a range of boat lengths. Usually, the longer the boat, the deeper the draft (depth of water needed by the boat). If a series of slips in one part of the marina have a shallower depth, perhaps because they are closer to shore, these slips are used to accommodate smaller, shallower draft boats. When lake levels drop, these slips either have to be dredged or a smaller boat moored there, or none at all.

Marinas also often rely on channels from the boat basin to a main channel for access to larger waters for boating. For example, on Kalamazoo Lake, there are several marinas along the shoreline. Kalamazoo Lake is fairly shallow, so deeper draft boats require a deep water slip, a deep water channel out from the marina and a deep water channel from there out to Lake Michigan. Anecdotal evidence reports that at least one marina operator believes the appropriate standard is to provide larger power boats about a 5' draft and sailboats a 10' draft. With a drop in Lake Michigan level, there may be no channel that provides 10' draft well up into Kalamazoo Lake and the marinas, even if the marinas dredge some of their slips to this depth. This would eliminate all larger sailboats from Kalamazoo Lake without substantial dredging. At extreme low water, there could be large areas between the main channel and shoreline marinas with less than 5' depth. This could eliminate access to and from many marinas in Kalamazoo Lake.

The situation in Wisconsin is not as dire. Most of the marina slips are located in boat basins that extend from shore out into Lake Michigan, protected by breakwaters. The basins are dredged to depths that accommodate large boats even with a drop in lake level. Generally, boats leaving these slips move directly from the boat basin out into the big lake.

Marinas in Michigan and Wisconsin were surveyed to determine the economic impact of current low waters and potential extreme low water (574.31' IGLD 1985). The survey was conducted by Michigan State University, Department of Park, Recreation and Tourism Resources (MSU) in the summer and fall of 2000. This survey builds on previous surveys of the boating industry conducted by MSU. Surveys were faxed to 750 marinas in Michigan and Wisconsin. Follow-up phone calls were made to marinas that did not initially respond. The apparent mood of marina operators made up to two or three calls necessary to obtain responses from a substantial portion of marinas.



The phone contacts often proved to be a painful experience for both surveyors and marina operators. Many operators reported being out of business due to low water and did not want to talk about the economic impacts of low water. When pressed that such information was then especially valuable, some of them cooperated and supplied useful data. The concept of extreme low water (compared to the current experience of low water) was difficult for operators to engage. Many could not fathom water levels dropping even 6" lower than 2000 (the COE potential extreme low is nearly 3' lower). Asking questions that operate outside the paradigm of the respondent made the survey very difficult to conduct. It was like asking a person whether they would rather borrow sugar or coffee from the Martian living next door.

It was clear that most marina operators believe their operations would cease long before Lake Michigan dropped to 574.31' (IGLD 1985).

As a result of a statewide survey of 130 marina operators conducted in the winter of 2000, it was estimated that about 3,500 slips in 115 commercial Great Lakes marinas were not usable due to low water. It was also estimated that another 2,457 slips were unable to accommodate the size boats they were designed to hold. There are an estimated 60,000 wet slips in Michigan Great Lakes marinas. Statewide, it was estimated that a 6" drop from 1999 levels would result in a loss of \$10.2 million and a \$17 million loss if the drop was 12". The water level in 2000 was about 12" lower than in 1999. (Mahoney, Tzu-Ching, Pistis and Martin, 2000)

#### *Survey of Marinas in Five Pilot Counties*

The first step in the study was to identify Great Lakes marinas in the two Michigan and three Wisconsin counties. The job was much easier in Michigan because Michigan State University did a complete on-site inventory of Great Lakes marinas in 1995 and they have done annual follow-up surveys of marinas each of the last three years. Comparable studies have not been conducted in Wisconsin and they do not have a statewide boating organization like the Michigan Boating Industries Association (MBIA). The Wisconsin marinas included in the study were identified from a combination of boating publications, search of yellow pages, and referrals from marina operators. Forty-four marinas were identified in the two Michigan counties and nine in the three Wisconsin counties. Only 38 of the Michigan marinas were sent surveys. The other six were not open during the time the survey was conducted in September 2000. Some had not opened at all, or closed very early in 2000 because of low water.

The marinas were faxed and/or mailed a two-page survey. If they failed to fax or return mail a completed survey they were contacted by telephone and in some instances the survey was administered then. Sixty-one percent (23) of the 38 Michigan marinas responded to the survey (Table 6). Eight of the nine (89%) Wisconsin marinas that were identified completed a survey. Again, the response

rate would have been higher in Michigan but marinas responding to the survey indicated that some marinas in their area were closed for the season because they were inaccessible because of low water in the marina or waterways (rivers, channels) that provide access to Lake Michigan.

The results from the analysis of surveys completed by marinas are reported in Tables 7 to 12. The results indicate that Michigan marinas have experienced more significant low water impacts than marinas in Wisconsin. A third (34%) of the Michigan marinas had slips that were unusable because of low water in 2000 (Table 7). We estimate that around 600 slips were unusable and the loss in slip revenues to these marinas was about \$600,000. This is consistent with a 2000 MSU marina study that estimated that approximately 6,000 slips were unusable statewide because of low water. Thirty percent of marinas had slips that could not accommodate the size of boats they were designed to hold and that cost marinas an additional \$184,000. In addition, there was a loss of \$ 200,000 in revenues due to inaccessible facilities, e.g., fuel pumps, launch facilities. Twenty two percent of the marinas were required to do special dredging because of low water. The average dredging project removed 7,600 yards and cost \$43,333. The cost includes removal and disposal. A number of marinas reported that even after incurring the cost of dredging in their marinas, access to Lake Michigan was blocked because dredging had not occurred in waterways that provided boating access. The direct economic impact (lost revenues and costs) on marinas in the two Michigan Counties is estimated to be \$2 million.

The impacts on the Michigan marinas are much greater if water levels drop an additional 12" in 2001. It is estimated the loss of revenues and additional cost to marinas in the two counties will be \$3.99 million (Table 8). Thirty nine percent of the marinas will be required to do additional dredging and the cost of this dredging to the marinas will be \$433,000. Seventy percent (70%) of the marinas will have unusable slips. Almost a thousand (961) slips will be unavailable. The loss of an additional 300 slips in 2001 could have a significant impact on slip availability in that the 2000 MSU Marina Study revealed that marinas in these counties are near 100% occupancy. Low water has effectively eliminated any surplus supply of marina slips and this has resulted in the highest increase in slip prices that we have experienced in the last 15 years. The MSU study showed that commercial marinas are also responding to the low water induced high occupancy rates by converting transient slips to seasonal rental slips reducing the capacity to accommodate touring boaters. This has implications for tourism and boater safety.

If 2001 water levels drop an additional 18" below the 2000 levels, the impact would be about \$4.2 million. See Table 9. Three-quarters of the marinas in the two counties will have unusable slips. The average loss in slip revenues will be approximately \$2.3 million. Almost 1100 slips will be unusable and an additional 144 slips will be unable to accommodate the size or type (e.g. deep draft sail boats) boats they were designed to hold.

It is important to recognize that for the most part these marinas are small businesses and this represents a substantial loss of revenues, in some cases catastrophic. A number of these marinas may not open for business again next season, especially if water levels continue to restrict access into and out of the marinas. Often when commercial marinas fail, they are converted to other land uses including retail and housing. The sites where the Wisconsin marinas are located also benefit from more regular maintenance dredging. The marinas there were not required to do special low water dredging and this greatly reduced their low water costs.

For a variety of reasons, including their locations and greater use of floating rather than fixed docks, Wisconsin marinas responding to the survey were less impacted during the 2000 boating season by low water levels. However, there were still impacts. Three of the nine marinas surveyed had (an average of 19) unusable slips. It is estimated that low water made 57 slips unusable and the revenue loss was approximately \$25,000 (Table 10). The total low water impact to the nine marinas in the three counties is estimated to be less than \$50,000. There was little disruption of boating opportunities and according to marina operators; few if any boaters had trouble finding slips to rent. However, the interviews with marina managers indicated that there was greater impact on boat launch sites throughout the three counties.

If water levels drop an additional 12" or 18" the low water impacts will be greater in Wisconsin but still much less than will be experienced in Michigan (Tables 11 and 12). Two-thirds of the marinas in the Wisconsin counties will have unusable slips if water levels drop an additional 12" or 18." It is estimated that 120 slips would be unusable if levels drop 12" and 138 slips with an 18" drop. The impact of an additional 12" drop will be approximately \$91,000 and \$118,000 with an 18" drop. **The general conclusion of Wisconsin marina operators is that the location of their marinas, relative newness of the facilities, design factors and floating docks worked together to minimize the impacts of low waters on their marinas.**

The average cost and revenue lost per wet slip was estimated at \$737 in 2000 in Michigan and \$78 in Wisconsin. If water levels dropped 12" or 18" the cost and revenue loss per slip would be \$1,084 and \$145 in Michigan and \$1,122 and \$180 in Wisconsin. (See Table 13)

**Table 6. Marinas, Dealerships and Charter Fishing Boats that Responded to the Surveys**

	<b>Sample Number</b>	<b>Response Number</b>	<b>Response Rate</b>
Michigan Marinas	38	23	61%
Wisconsin Marinas	8	8	89%
Total Marinas	47	31	66%
Dealerships	35	29	83%
Charter Boats	68	58	85%

*Source: Michigan State University*

Table 7. Impacts of Low Water on Marinas in Allegan and Ottawa Counties in 2000\*

Impacts	%(#) of all marinas in Allegan & Ottawa	Average # of unusable slips per marina	Estimated # of total unusable slips by marinas in Allegan & Ottawa	Average lost revenues per marina	Estimated total lost revenues to all marinas in Allegan & Ottawa
Unusable wet slips	34% (15)	42	630	\$39,309	\$589,635
Wet slips that could not handle the size boats designed for	30% (13)	7	91	\$14,167	\$184,171
	%(#) of all marinas in Allegan & Ottawa	Average # of yards removed per marina	Estimated total # of yards removed by marinas in Allegan & Ottawa	Average cost of dredging per marina	Estimated total cost of dredging to all marinas in Allegan & Ottawa
Dredging due to low water	22% (10)	7,600	76,000	\$43,333	\$433,330
	% of all marinas in Allegan & Ottawa		Estimated # of marinas that have 'damage to docks, piers & breakwalls in Allegan & Ottawa	Average cost of damage per marina	Estimated total cost of damage to all marinas in Allegan & Ottawa
Damage to docks piers & breakwalls	13%	NA	6	\$10,083	\$60,498
	% of all marinas 'In Allegan & Ottawa		Estimated # of marinas that have inaccessible facilities in Allegan ' & Ottawa	Average cost of lost revenues per marina	Estimated total cost due to inaccessible facilities
Inaccessible facilities (fuel, pumpouts)	9%	NA	4	\$50,000	\$200,000
	% of all marinas in Allegan & Ottawa		Estimated # of marinas that have new or rebuilding of marina facilities in Allegan & Ottawa	Average cost of facilities per marina	Estimated total cost due to new or rebuilding of facilities
New or rebuilding of facilities	17%	NA	8	\$7,833	\$62,664
	% of all marinas in Allegan & Ottawa		Estimated # of marinas that have other impacts, damage or loss in Allegan & Ottawa	Average other cost per marina	Estimated total cost due to other impacts, damages
Other impacts or damage or loss	17%	NA	8	\$66,250	\$530,000
<b>TOTAL VALUE OF IMPACTS ON MARINAS IN OTTAWA AND ALLEGAN COUNTIES</b>					<b>\$2,060,298</b>

\* It estimated that there are 44 marinas in Allegan & Ottawa Counties

NA = Not applicable

**Table 8. Projected Impacts of an Additional 12" Drop in Water Levels in 2000 in Allegan & Ottawa Counties\***

Impacts	%(#) of all marinas in Allegan & Ottawa	Average # of unusable slips per marina	Estimated # of total unusable slips by marinas in Allegan & Ottawa	Average lost revenues per marina	Estimated total lost revenues to all marinas in Allegan & Ottawa
Unusable wet slips	70% (31)	31	961	\$57,447	\$1,780,857
Wet slips that could not handle the size boats designed for	26% (12)	12	144	\$24,583	\$294,996
	%(#) of all marinas in Allegan & Ottawa	Average # of yards removed per marina	Estimated total # of yards removed by marinas in Allegan & Ottawa	Average cost of dredging per marina	Estimated total cost of dredging to all marinas in Allegan & Ottawa
Dredging due to low water	39% (17)	5,567	94,639	\$39,511	\$671,687
	% of all marinas in Allegan & Ottawa		Estimated # of marinas that have damage to docks, piers & breakwalls in Allegan & Ottawa	Average cost of damage per marina	Estimated total cost of damage to all marinas in Allegan & Ottawa
Damage to docks piers & breakwalls	22%	NA	10	\$21,500	\$215,000
	% of all marinas in Allegan & Ottawa		Estimated # of marinas that have inaccessible facilities in Allegan & Ottawa	Average cost of lost revenues per marina	Estimated total cost due to inaccessible facilities
Inaccessible facilities (fuel, pumpouts)	13%	NA	6	\$111,667	\$670,002
	% of all marinas in Allegan & Ottawa		Estimated # of marinas that have new or rebuilding of marina facilities in Allegan & Ottawa	Average cost of facilities per marina	Estimated total cost due to new or rebuilding of facilities
New or rebuilding of facilities	4%	NA	2	\$75,000	\$150,000
	% of all marinas in Allegan & Ottawa		Estimated # of marinas that have that have other impacts, damage or loss in Allegan & Ottawa	Average other cost per marina	Estimated total cost due to other impacts, damages
Other impacts or damage or loss	9%	NA	4	\$8,000	\$32,000
<b>TOTAL VALUE OF PROJECTED IMPACTS OF ADDITIONAL DROP IN WATER LEVELS IN ALLEGAN AND OTTAWA COUNTIES</b>					<b>\$3,814,542</b>

\* It estimated that there are 44 marinas in Allegan & Ottawa Counties

NA = Not applicable

**Table 9. Projected Impacts of an Additional 18" Drop in Water Levels in 2000 in Allegan & Ottawa Counties\***

Impacts	%(#) of all marinas in Allegan & Ottawa	Average # of unusable slips per marina	Estimated # of total unusable slips By marinas in Allegan & Ottawa	Average lost revenues per marina	Estimated total lost revenues to all marinas in Allegan & Ottawa
<b>Unusable wet slips</b>	74% (33)	33	1,089	\$60,419	\$1,993,827
<b>Wet slips that could not handle the size boats designed for</b>	26% (12)	12	144	\$24,583	\$294,996
	%(#) of all marinas in Allegan & Ottawa	Average # of yards removed per marina	Estimated total # of yards removed by marinas in Allegan & Ottawa	Average cost of dredging per marina	Estimated total cost of dredging to all marinas in Allegan & Ottawa
<b>Dredging due to low water</b>	39% (17)	7,356	125,052	\$49,578	\$842,826
	% of all marinas in Allegan & Ottawa		Estimated # of marinas that have damage to docks, piers & breakwalls in Allegan & Ottawa	Average cost of damage per marina	Estimated total cost of damage to all marinas in Allegan & Ottawa
<b>Damage to docks piers &amp; breakwalls</b>	17%	NA	8	\$41,375	\$331,000
	% of all marinas in Allegan & Ottawa		Estimated # of marinas that have inaccessible facilities in Allegan & Ottawa	Average cost of lost revenues per marina	Estimated total cost due to inaccessible facilities
<b>Inaccessible facilities (fuel, pumpouts)</b>	9%	NA	4	\$115,000	\$460,000
	% of all marinas in Allegan & Ottawa		Estimated # of marinas that have new or building of marina facilities in Allegan & Ottawa	Average cost of facilities per marina	Estimated total cost due to new or rebuilding of facilities
<b>New or rebuilding of facilities</b>	4%	NA	2	\$125,000	\$250,000
	% of all marinas in Allegan & Ottawa		Estimated # of marinas that have other impacts, damage or loss in Allegan & Ottawa	Average other cost per marina	Estimated total cost due to other impacts, damages
<b>Other impacts or damage or loss</b>	9%	NA	4	\$8,000	\$32,000
<b>TOTAL VALUE OF PROJECTED IMPACTS OF ADDITIONAL DROP IN WATER LEVELS IN ALLEGAN AND OTTAWA COUNTIES</b>					<b>\$4,204,649</b>

\* It estimated that there are 44 marinas in Allegan & Ottawa Counties

NA = Not applicable

Table 10. Impacts of Low Water on Marinas in Three Wisconsin Counties in 2000\*

Impact	%(#) of all marinas In Wisconsin	Average # of unusable slips per marina	Estimated # of total unusable slips by marinas in Wisconsin	Average lost revenues per marina	Estimated total lost revenues to all marinas in Wisconsin
Unusable wet slips	33% (3)	19	57	\$8,033	\$24,099
Wet slips that could not handle the size boats designed for	None reported	None reported	None reported	None reported	None reported
	%(#) of all marinas In Wisconsin	Average # of yards removed per marina	Estimated total # of yards removed by marinas in Wisconsin	Average cost of dredging per marina	Estimated total cost of dredging to all marinas in Wisconsin
Dredging due to low water	No dredging reported	No dredging reported	No dredging reported	No dredging reported	No dredging reported
	% of all marinas In Wisconsin		Estimated # of marinas that have damage to docks, piers & breakwalls in Wisconsin	Average cost of damage per marina	Estimated total cost of damage to all marinas in Wisconsin
Damage to docks piers & breakwalls	No damage reported	No damage reported	No damage reported	No damage reported	No damage reported
	% of all marinas In Wisconsin		Estimated # of marinas that have inaccessible facilities in Wisconsin	Average cost of lost revenues per marina	Estimated total cost due to inaccessible facilities
Inaccessible facilities (fuel, pumpouts)	25%		2	\$5,000	\$10,000
	% of all marinas In Wisconsin		Estimated # of marinas that have new or rebuilding of marina facilities in Wisconsin	Average cost of facilities per marina	Estimated total cost due to new or rebuilding of facilities
New or rebuilding of facilities	25%		2	\$5,500	\$11,000
	% of all marinas In Wisconsin		Estimated # of marinas that have other impacts, damage or loss in Wisconsin	Average other cost per marina	Estimated total cost due to other impacts, damages
Other impacts or damage or loss	None reported		None reported	None reported	None reported
TOTAL VALUE OF IMPACTS IN MANITOWOC, OZAUKEE AND SHEBOYGAN COUNTIES					\$45,099

\* It estimated that there are 9 marinas in the three Wisconsin counties of Manitowoc, Ozaukee and Sheboygan.



**Table 11. Projected Impacts of an Additional 12" Drop in Water Levels in 2000 in Three Wisconsin Counties\***

Impact	%(#) of all marinas In Wisconsin	Average # of unusable slips per marina	Estimated # of total unusable slips by marinas in Wisconsin	Average lost revenues per marina	Estimated total lost revenues to all marinas in Wisconsin
Unusable wet slips	63%(6)	20	120	\$12,295	\$73,770
Wet slips that could not handle the size boats designed for	NA	NA	NA	NA	NA
	%(#) of all marinas In Wisconsin	Average # of yards removed per marina	Estimated total # of yards removed by marinas in Wisconsin	Average cost of dredging per marina	Estimated total cost of dredging to all marinas in Wisconsin
Dredging due to low water	NA	NA	NA	NA	NA
	% of all marinas In Wisconsin		Estimated # of marinas that have damage to docks, piers & breakwalls in Wisconsin	Average cost of damage per marina	Estimated total cost of damage to all marinas in Wisconsin
Damage to docks piers & breakwalls	NA	NA	NA	NA	NA
	% of all marinas in Wisconsin		Estimated # of marinas that have inaccessible facilities in Wisconsin	Average cost of lost revenues per marina	Estimated total cost due to inaccessible facilities
Inaccessible facilities (fuel, pumpouts)	25%	NA	2	\$5,500	\$11,000
	% of all marinas In Wisconsin		Estimated # of marinas that have new or rebuilding of marina facilities in Wisconsin	Average cost of facilities Per marina	Estimated total cost due to new or rebuilding of facilities
New or rebuilding of facilities	13%	NA	1	\$6,100	\$6,100
	% of all marinas In Wisconsin		Estimated # of marinas that have that have other impacts, damage or loss in Wisconsin	Average other cost per marina	Estimated total cost due to other impacts, damages
Other impacts or damage or loss	NA	NA	NA	NA	NA
<b>TOTAL VALUE OF PROJECTED IMPACTS OF ADDITIONAL DROP IN WATER LEVELS IN MANITOWOC, OZAUKEE AND SHEBOYGAN</b>					<b>\$90,870</b>

\* It estimated that there are 9 marinas in the three Wisconsin counties of Manitowoc, Ozaukee and Sheboygan.  
NA = Not applicable

**Table 12. Projected Impacts of an Additional 18" Drop in Water Levels in 2000 in Three Wisconsin counties\***

Impacts	%(#) of all marinas in Wisconsin	Average # of unusable slips per marina	Estimated # of total unusable slips by marinas in Wisconsin	Average lost revenues per marina	Estimated total lost revenues to all marinas in Wisconsin
Unusable wet slips	63% (6)	23	138	\$15,215	\$91,290
Wet slips that could not handle the size boats designed for	13% (1)	5	5	\$4,000	\$4,000
	%(#) of all marinas in Wisconsin	Average # of yards removed per marina	Estimated total # of yards removed by marinas in Wisconsin	Average cost of dredging per marina	Estimated total cost of dredging to all marinas in Wisconsin
Dredging due to low water	NA	NA	NA	NA	NA
	% of all marinas in Wisconsin		Estimated # of marinas that have damage to docks, piers & breakwalls in Wisconsin	Average cost of damage per marina	Estimated total cost of damage to all marinas in Wisconsin
Damage to docks piers & breakwalls	NA	NA	NA	NA	NA
	% of all marinas in Wisconsin		Estimated # of marinas that have inaccessible facilities in Wisconsin	Average cost of lost revenues per marina	Estimated total cost due to inaccessible facilities
Inaccessible facilities (fuel, pumpouts)	25%	NA	2	\$5,500	\$11,000
	% of all marinas in Wisconsin		Estimated # of marinas new or rebuilding of marina facilities in Wisconsin	Average cost of facilities per marina	Estimated total cost due to new or rebuilding of facilities
New or rebuilding of facilities	25%	NA	2	\$6,100	\$12,200
	% of all marinas in Wisconsin		Estimated # of marinas that have other impacts, damage or loss in Wisconsin	Average other cost per marina	Estimated total cost due to other impacts, damages
Other impacts or damage or loss	NA	NA	NA	NA	NA
<b>TOTAL VALUE OF PROJECTED IMPACTS OF ADDITIONAL DROP IN WATER LEVELS IN MANITOWOC, OZAUKEE AND SHEBOYGAN</b>					<b>\$118,490</b>

\* It estimated that there are 9 marinas in the three Wisconsin counties of Manitowoc, Ozaukee and Sheboygan.  
NA = Not applicable

**Table 13. Average Dredging Cost per Slip and Average Total Cost of Low Water per Slip**

	<b>Average Dredging Cost per Wet Slip*</b>	<b>Average Total Cost and Total Revenue Lost per Wet Slip</b>
<b>Marinas in Michigan</b>		
2000 Water Levels	\$188	\$737
If Water Levels Drop 12"	\$273	\$1,084
If Water Levels Drop 18"	\$342	\$1,122
<b>Marinas in Wisconsin</b>		
2000 Water Levels	NA	\$78
If Water Levels Drop 12"	NA	\$145
If Water Levels Drop 18"	NA	\$180

\*Many marinas did dredging in 1999 and 2000

NA = Not available, likely because no dredging was needed.

*Source: Michigan State University*

#### *Repairs to Docks and Other Structures*

The wood used to build docks, seawalls and related structures is vulnerable to changes in water level. The wood is usually pressure treated and under normal use will resist damage from water for a very long time. Often the specifications for this wood call for a treatment that should last about 40 years. Structures made from such wood that have been submerged for a number of years and then exposed to the air for an extended period can suffer oxidation. Many marinas report having to replace formerly submerged, wooden structures due to recent, prolonged exposure to air.

In addition to oxidation damage, marinas have had to build ladders or similar structures to get boaters from high, fixed docks down to their boats, floating on lowered waters.

Fewer new marinas have fixed height docks, but those that do face problems from both extremes of water level. When the water level is very high, boats can ride over the docks, causing damage. Some form of increased protection is then necessary to hold boats away from the dock. At one of the focus groups held in Wisconsin in 1999, there was a comment about the height of the docks at one marina never being right, but always too low or too high. Increased use of floating docks would address this and is apparently the direction most marinas are taking.

The statewide survey of marina operators in Michigan in 2000 found that with a drop in water levels below those of 1999, 28% will have inaccessible facilities

and 20% will have to rebuild docks or build new facilities. (Mahoney, Tzu-Ching, Pistis and Martin, 2000)



**Photo 4. Fixed-height docks can pose problems for boaters during both low water and high. Here, it can be difficult to climb down into the boats.**

#### *Dredging Costs*

In the past few years, many marinas have engaged in dredging in order to stay in business. The costs varied due to method of dredging, amount of material removed and other factors. Eighty-eight marinas throughout Michigan reported spending an average of \$52,000 during 1999 on dredging. (Mahoney, Tzu-Ching, Pistis and Martin, 2000) Marinas in the study area reported spending an average of \$43,330 on dredging in 2000. Only Michigan marinas reported dredging in 2000; none of the marinas responding in the Wisconsin pilot counties dredged. Total estimated spending on dredging in the study counties was \$433,330 in 2000.

Marinas tend to arrange for dredging on an individual basis, which could be a serious mistake. They usually have to rely on a public authority to do channel dredging so that boats moored in their facility have access to open water. With a potential drop in Lake Michigan levels of up to another three feet, coordinated dredging will be vital. Individual dredging projects at marinas may not keep many marinas in business without additional projects to dredge main and connecting channels. While federal authorities (COE) try to plan for and implement channel dredging on an as-needed basis, they usually have to prioritize and implement

based on available funding. Coordinated local, state and federal planning could provide more funding and earlier results for some areas. Marina owners will also have to become more involved in planning for dredging projects.

The average cost to dredge per wet slip was \$188 in Michigan in 2000. At another drop of 12" or 18" the average cost would be \$272 in Michigan and \$42 in Wisconsin. These were no costs for Wisconsin as dredging has not been and likely will not be needed. (See Table 13)

#### *High Water Impacts to Marinas*

Marinas were surveyed in 2000 by Michigan State University about the economic impacts of changing water levels. Because the past few years have had relatively low water levels, the focus of marina operators was on low water. The experience of the survey staff was that marina operators were so concerned with low water that they were unable to comprehend problems from high water.

However, some problems with high waters could be expected by marinas. These include structural adjustments and problems with access.

Just as marina operators have had to build ladders down from fixed height docks so the boat owners can get into the boats during recent lower waters, there may be problems with dock height at high water. In some locations, an extreme high water level of 583.41' IGLD 1985 might overtop fixed docks. These docks would need to be raised to provide access to moored boats. In other locations, the boats might ride too high and suffer damage from the docks. This could require additional fender systems, flexible anchoring rods or vertical posts to prevent boats from riding over the docks.

Some marinas are located in river floodplains. If a drowned river mouth becomes flooded as a result of high Lake Michigan levels, the parking lots or access roads to marinas may become impassible.

#### *Total Economic Impact to Marinas*

The economic impact to marinas of low water is the total of lost slip revenue, increased dredging costs and damage (or alterations needed) to dock and other structures.

The total impact for marinas in the five study counties for 2000 and future low water years at progressively lower water is shown in Table 14.

**Table 14. Economic Impact to Marinas in Five Counties on Lake Michigan at Different Lake Levels**

<b>Pilot County/State</b>	<b>Economic Impact \$</b>		
	<b>Year 2000</b>	<b>12" Drop below 2000</b>	<b>18" Drop below 2000</b>
Allegan & Ottawa/Michigan	\$2,060,298	\$3,814,542	\$4,204,649
Manitowoc, Ozaukee & Sheboygan/Wisconsin	\$45,099	\$90,870	\$118,490
<b>Total</b>	<b>\$2,105,397</b>	<b>\$3,905,412</b>	<b>\$4,323,139</b>

*Impact of Reduced Marina Capacity on Spending in the Community*

The economic impact to non-boating businesses in Allegan and Ottawa Counties is difficult to estimate because it can not be determined how many of the boats that would have been stored in marina slips in 2000 were moved/stored outside the two counties because slips were unusable due to low water. However, as mentioned earlier in the report, the occupancy of marinas in the two counties averaged 99% during the 2000 boating season meaning that there was no excess capacity remaining for marinas to accommodate additional boats displaced from other marinas in the counties because of low water. Low water has eliminated the 10-12% slip surplus that existed in many regions of Michigan between 1996 and 1999. This will drive up the price of wet slips an average of 8% in many areas of Michigan for the 2001 boating seasons. This is the largest average increase in more than 10 years.

In addition to spending at marinas for wet slips, winter storage and repairs, the average annual spending by a 29' or larger boat stored in a marina in Michigan is approximately \$8,500 per year including \$3,100 on trip related spending (e.g., boat fuel, lodging, food) and \$5,400 in annual expenses (not including slippage, winter storage, boating equipment, insurance). These figures are from previous studies by MSU. (Stynes et al, 1998) The annual expenses include slip rental, winter storage, equipment purchases, insurance and repairs and maintenance. A very conservative estimate is that boats stored in marinas spend an average of \$2,500, not counting what they spend in marinas, in other businesses in the communities where the marina is located. If water levels fall another 12" in Allegan and Ottawa counties, 330 additional slips will be unusable and many of those boats will have to find slippage in other counties. The direct annual revenue impact to businesses in the two counties would be approximately \$825,000. If water levels fall 18" below 2000 levels, 1,100 slips would be unavailable and the loss in annual spending to local businesses would be \$1.15 million. See Table 15.

The total direct impact of an additional 12" drop in water levels will be \$4.75 million. The impact increases to \$5.35 million if water levels drop 18" below 2000 levels.

**Table 15. The Direct Economic Impact to Marinas and Non-boating Businesses of a Further Drop in Water Levels in Allegan and Ottawa Counties**

Water Level	Unusable Slips	Financial Loss to Marinas	Spending Loss to Non-boating Businesses	Total Direct Impact
2000 water levels	630	\$2 million	*	*
12" below the 2000 level	961	\$3.9 million	\$825,000	\$4.75 million
18" below the 2000 level	1089	\$4.2 million	\$1.15 million	\$5.35 million

\* In 2000 there were still excess slips in the two counties and therefore most of the boats displaced because of low waters could have secured rental slips in other marinas in the two counties. It is difficult to estimate the number of displaced boats that were moved outside the two counties.

### **Estimate of Boat Repair Costs Due to Low Water**

#### *Types of Boat Damage Due to Low Water*

Boats receive different types of damage related to low water. The primary type of damage is to the propellers and lower drive housings that strike submerged objects or the bottom. Hull damage from striking objects underwater is also more frequent with low water. Sailboats can receive damage to keels or rudders from hitting underwater objects or from going aground. Boats moored in shallow water and not attended to as waters recede can end up sitting on mud flats. While this may not be any more stress on a boat than dry storage, the boats are exposed to the elements. It may also be difficult to remove them for a long time.

Although it was the intent of this study to quantify boat damage due to low water, an accurate estimate of the repair costs proved difficult. Boat repair facilities do not keep records sufficiently detailed to distinguish the source of damage. It was hoped that the increase in business in boat repair facilities could serve as a rough measure. Phone calls to marinas and boat repair facilities conducted by Michigan State University in 2000 found that facility operators reported no significant increase in business. Conjecture on this situation suggests that there was an increase in repairs due to low water but that repair business overall was about the same. If fewer boats were put in the water there may have been a decline in normal maintenance and accident repair. An increase in low water damages filled the void.

The EPIC MRA survey of boaters did ask about spending related to low water damages. Respondents report spending an average of about \$218 on repair of damages specifically related to low water levels. In Michigan the average was \$190 with a range of 0 to \$3,200 (the latter on a 21' boat). In Wisconsin the

average repair cost was \$246 with the range from 0 to \$6,000 (on a 23' boat). Relatively few respondents reported damages, so the overall average is based on all respondents and not just on those experiencing damage.

It appears that a useful, future approach would be to supply boat repair shops with a survey or tracking form at the beginning of the season for them to keep a record. As an alternative, boat repair shops could be surveyed monthly, a period in which they may still be able to estimate with some accuracy the proportion of business due to low water damages.

### **Impact of Low Water on Watercraft Sales through Dealerships**

Thirty-five watercraft dealerships were identified in the pilot Michigan counties. They were identified through a combination of a search of SIC codes, exploring telephone yellow pages in those counties, and Michigan Boating Industries Association's membership directory. Eighty-three percent of the dealerships contacted by mail, fax, or follow-up telephone calls responded to the survey.

Dealerships in Wisconsin were not surveyed because the marina operators did not indicate significant low water related problems that would noticeably impact watercraft sales. Several calls to Wisconsin watercraft dealerships affirmed this conclusion. It would have been extremely difficult for Wisconsin dealerships to estimate the impacts on watercraft sales of low water separate from gasoline prices and weather conditions.

There appears to have been little overall impact of low water on watercraft sales in the two Michigan counties. Dealerships experiencing reduced sales were off set by ones that had better sales in 2000. Forty-one percent of dealerships indicated sales were less than in 1999 (Table 16). Dealerships with reduced sales averaged a 20% decrease compared to 1999. The revenue impact on these dealerships was significant. A quarter of the dealerships that experienced lower sales believed that low water was a contributing factor. However, other factors were also mentioned, including higher gasoline prices and poor weather. It is difficult to determine how much, or to what extent low water negatively impacted watercraft sales because of a coincidence of negative factors – low water, unfavorable weather, high fuel prices.

Conversely, more than one-third of the dealerships indicated increased sales averaging 32% above 1999 levels. So, it appears that low water levels did not significantly impact overall watercraft sales. But, it is important to recognize that a significant percentage of 2000 boat sales occurred prior to the beginning of the boating season. Persons who purchased boats early in the season may not have been aware of the extent of the low water problem and therefore may have not incorporated it in their buying decisions. Although low water reduced access to some marinas and boating opportunities other boating opportunities were available especially for *trailerable* boats. Thus, to the extent low water is impacting on boating sales, it is likely to be much more evident in 2001.



### **Impact of Low Water on Charter Fishing**

Charter fishing operations in Allegan and Ottawa counties were identified by: consulting the Michigan Charter Boat Association's Directory and Web Page, a yellow page search, and contacting local convention and visitor bureaus. Sixty-eight charter fishing operations were identified and either faxed or mailed a short questionnaire. A very high percentage (85%) either returned a completed questionnaire, or they were interviewed on the telephone (Table 17).

Charter fishing boats in Allegan and Ottawa counties experienced some negative impacts associated with low water (Table 17). However, it is difficult to accurately estimate the cost associated with these impacts because often it involved changing their operations (e.g., their normal slip was unavailable, they had to move docking locations) as opposed to lost charters. The majority (83%) of the charter fishing businesses that were surveyed experienced no negative impacts associated with low water levels. Seventeen percent (10) of the 58 charter-fishing captains operating in the two counties experienced some type(s) of low water impacts. About half of those indicated fewer charters in 2000 compared to 1999 and they attributed that in part to low water. However, it is difficult, as it was in the case of dealerships, to determine the extent to which the reduced number of fishing charters was caused by low water rather than unfavorable weather conditions.

Table 17 also reveals the tendency to overstate or project the negative impacts of low water. Sixty-eight charter-fishing operations were identified and 58 responded to the survey. Only nine (17%) indicated that they experienced negative low water impacts. However, 43% of the captains indicated that they knew at least one charter fishing boat in their area that experienced negative low water impacts, which means they may be over-estimating the impacts of low water on charter fishing.

Low water impacted the operations of some charter fishing boats in Allegan and Ottawa. Availability and access to dockage will become more difficult if water levels drop 12" or 18" below 2000 levels. Based on projections (e.g., unusable slips) provided by the marinas, charter fishing operations will find it more difficult and costly to secure slips at locations that are conveniently accessible to customers. It is very likely that if water levels fall below 2000 levels, and if there is not substantial additional dredging, more charter fishing operations in the two counties will suffer increased costs and reduced revenues.

**Table 16. Dealerships that Reported Increased and Decreased Sales in 2000 Compared to 1999**

<b>Change in Sales</b>	<b>Amount of Change</b>
Increase in 2000	35%
Average % Increase in Sales	32%
No Change in 2000	24%
Decreased Sales in 2000	41%
Average % Reduction in Sales	20%
Average % Reduction Due to Low Water	25%

Note: The number of dealers responding to the survey was 29 of 35.

Source: Michigan State University

**Table 17. Impact of Low Water on Michigan Charter Fishing Boats in 2000**

<b>Charter Boat Response</b>	<b>Percent</b>
% Charter Boats Impacted by Low Water	17%
Type of Low Water Impacts	
Fewer Charters	40%
Slips Unavailable	20%
Damage to Boats	20%
Other Impacts	50%
Perceived Low Water Level Negatively Impacted Other Charter Boats in Area	
	43%
Types of Low Water Impacts	
Slip Availability	12%
Docking and Customer Access Problems	24%
Had to Move Dock Location	36%
Lost Revenues	8%

Source: Michigan State University

### **Low Water Impact on Public Boat Launch Ramp Use**

Within the study area and adjacent counties, the study team located 55 public boat launch ramps. Public ramps are provided by the States of Michigan and Wisconsin, counties, cities and townships. There are a few privately owned boat launch ramps within the study area but these were not studied because of time constraints and limited reliable information on where to find them.

All of the ramps in the study area and adjacent counties that appeared on published lists were visited. Some road ends were visited but it was not feasible to check every road that the map showed ended at Lake Michigan along 500 miles of coast or that ended at connecting lakes. Aerial photographs were checked to identify road-end launch sites and those road-ends that appeared promising were visited. Water depth at the end of the ramp was measured where there was water. At some locations, the water was still enough for an accurate measurement, but where the water was rough, an average water line was established by observation. On ramps where the water level was below that of the end of the ramp, the vertical distance from the end of the ramp to the water was measured. This was done by extending a string with a string level attached from a stake at the end of the ramp to a point over the water and taking a measurement from the string down to the water. These latter ramps were unusable in the summer of 2000 and would remain unusable at even lower levels without modification. One Wisconsin ramp (Amsterdam Park) appeared to have been modified between 1999 and 2000, extending it to reach the water (personal observation, Warbach, 1999 and 2000).

#### *Types of Boat Launch Ramps in Study Area*

Not all boat ramps are constructed in the same fashion. Some are made of cast-in-place concrete; others are made of pre-cast concrete panels while others are made of metal grids. The concrete ramps visited had a variety of surface finishes to provide traction when wet. Many had shallow groves cut into them at right angles to the slope. Others had deep groves and ridges cast into them while others had only a rough, broom-brushed surface. Some of the road end access sites had only gravel to extend past the paved road surface. At low water, launching without getting stuck may depend on the lake bottom soil being solid enough to support a vehicle and trailer. The lake bottom soil varied from packed gravel, to gravel and cobble, to sand, to solid rock shelf (the latter at North Point Park, Sheboygan, Wisconsin).

There are also differences in scale of boat launch facilities. Small facilities typically have the capacity to launch one boat at a time and only about a dozen spaces to park boat trailers. Larger facilities can launch up to ten boats at a time and have parking for up to a hundred or more trailers. As mentioned earlier, there are access sites at road ends that are used to launch boats when conditions permit. Generally these are used for smaller boats or personal watercraft. Parking is often a problem at these sites and conflicts with adjacent property owners can occur. Road-end ramps are often unpaved.



**Photo 5. Adjustable dock can be fastened at different points on ramp to adjust for changing water levels.**

*Boating Access as Affected by Potential Water Level Changes*

Table 18 shows the water depth at the end of the launch ramps in the study area under various water level scenarios. Fifty-five ramps were inspected and measured in August 2000. Twenty of these were in Michigan and thirty-five were in Wisconsin. The table shows water depth during August 2000, at the mean 1999 level, the equivalent depth during the record low of 1964 (if the boat ramp had been constructed then) and at the potential extreme low and high water levels. The record 1964 low is just over a foot lower than the level in August 2000.

While the August 2000 levels already produced problems for many boat launches, enough were still operational to provide access to Lake Michigan at reasonable intervals along the coast. Boaters would not have to drive more than about an hour in any direction from a closed access site to one that was open. Eighteen ramps of the 55 were closed, completely dry or had too little water for a sizable boat. See Map 1.

**Table 18. Boat Launch Ramp Potential Depths at Different Lake Michigan Water Levels**

Launch Ramp Location & MDNR Map Code #	Water Depth at End of Ramp August 2000 in Inches (577.9' IGLD 1985)	Water Depth at End of Ramp Average 1999 (578.9' IGLD 1985) in Inches	Water Depth at End of Ramp 1964 Record Low (576.7' IGLD 1985) in Inches (if ramp had been built)	Water Depth at End of Ramp at Potential Extreme Low (574.3' IGLD 1985) in Inches	Water Depth at End of Ramp at Potential Extreme High (583.4' IGLD 1985) in Inches
<b>Michigan</b>					
<b>Allegan County</b>					
Center Street, Douglas	-8	4	-22	-51	58
Howard Schultz Park - 21	48	60	34	5	114
<b>Berrien County</b>					
St. Joseph, Marina Island	72	84	58	29	138
Benton Harbor St. Joseph River - 12	53	65	39	10	119
<b>Muskegon County</b>					
Montegue-White Lake - 8	42	54	28	-1	108
White Lake Park	0	12	-14	-43	66
Mona Lake Park	16	28	2	-27	82
Muskegon State Park Snug Harbor - 4	42	54	28	-1	108
Hartshorn Municipal Marina - 6	14	26	0	-29	80
Fisherman's Landing, Muskegon - 7	42	54	28	-1	108
Cottage Grove, City of Muskegon - 10	42	54	28	-1	108
Grand Trunk, City of Muskegon - 12	38	50	24	-5	104
<b>Ottawa County</b>					
Lake Macatawa - 1	36	48	22	-7	102
Kollen Park - 9	56	68	42	13	122
Howard Dunton Park - 16	52	64	38	9	118
Mill Point Park - Spring Lake	8	20	-6	-35	74
Petty's Bayou, Spring Lake - 2	54	66	40	11	120
Grand Haven Municipal - 10	39	51	25	-4	105
Pigeon Lake - 11	54	66	40	11	120
<b>Van Buren County</b>					
Black River Park - 27	50	62	36	7	116

Table 18 Continued...

Table 18 continued

Launch Ramp Location	Water Depth at End of Ramp August 2000 in Inches (577.9' IGLD 1985)	Water Depth at End of Ramp Average 1999 (578.9' IGLD 1985) in Inches	Water Depth at End of Ramp 1964 Record Low (576.7' IGLD 1985) in Inches (if ramp had been built)	Water Depth at End of Ramp at Potential Extreme Low (574.3' IGLD 1985) in Inches	Water Depth at End of Ramp at Potential Extreme High (583.4' IGLD 1985) in Inches
<b>Wisconsin</b>					
<b>Brown County</b>					
Bayshore County Park	39	51	25	-4	105
Volks Landing	6	18	-8	-37	72
Comuniversity Park	-21	-9	-35	-64	45
Green Bay Metro Boat Launch	59	71	45	16	125
Fox Point Access	42	54	28	-1	108
Brown County Fairgrounds	18	30	4	-25	84
Ashwaubomay Park	13	25	-1	-30	79
Suamico Access	32	44	18	-11	98
<b>Door County</b>					
Potawatami State Park*	24	36	10	-19	90
Sawyer Park, Sturgeon Bay	72	84	58	29	138
Sunset Park, Sturgeon Bay	42	54	28	-1	108
Sand Bay Beach	6	18	-8	-37	72
Sugar Creek Park	0	12	-14	-43	66
Chaudior's Dock County Park	29	41	15	-14	95
<b>Kewaunee County</b>					
Kewaunee Landing	38	50	24	-5	104
Steel Street Point, Algoma	42	54	28	-1	108
Olson Park, Algoma	6	18	-8	-37	72
Red River County Park	0	12	-14	-43	66

Table 18 Continued...

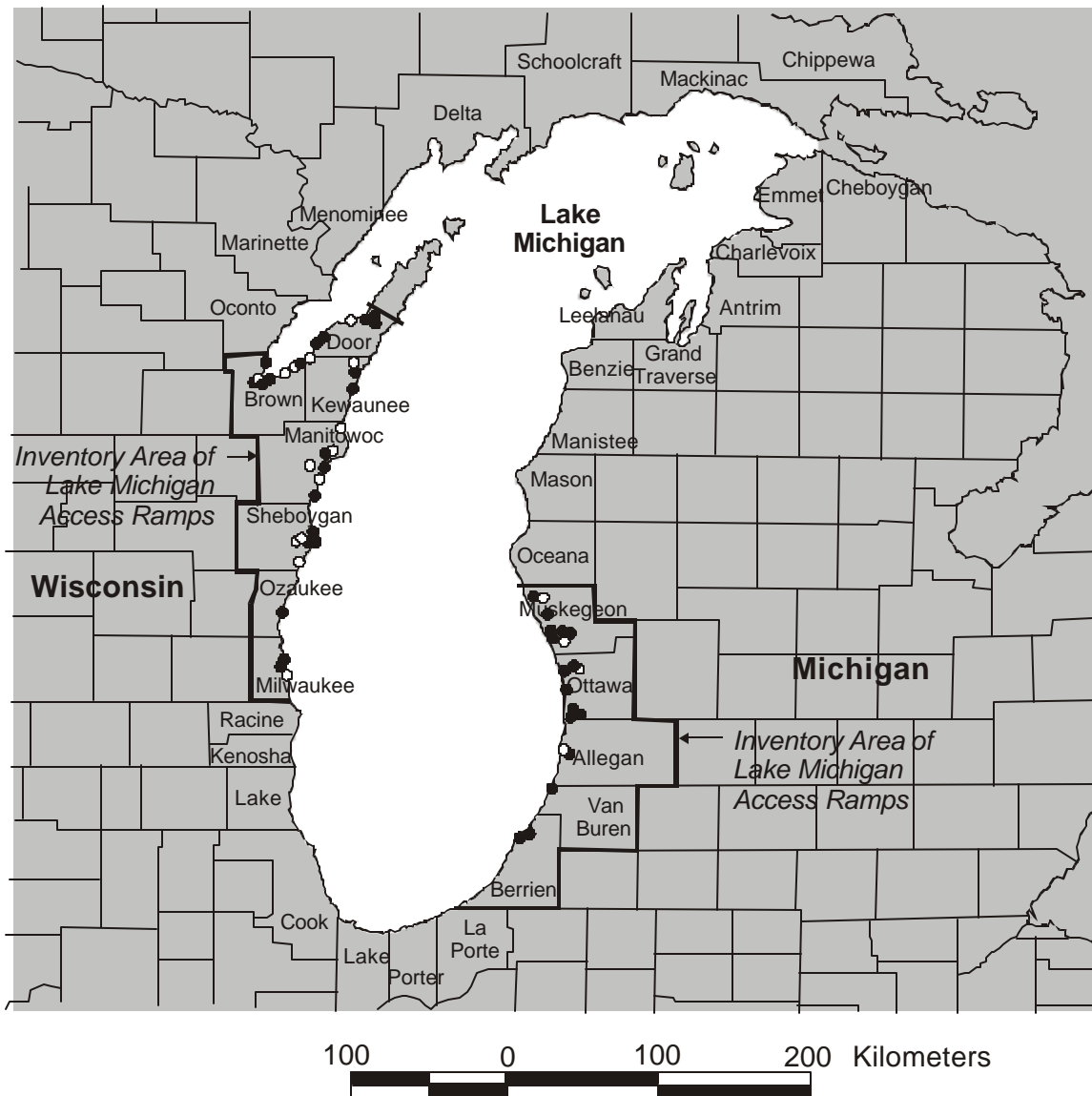
Table 18 Continued

Launch Ramp Location	Water Depth at End of Ramp August 2000 in Inches (577.9' IGLD 1985)	Water Depth at End of Ramp Average 1999 (578.9' IGLD 1985) in Inches	Water Depth at End of Ramp 1964 Record Low (576.7' IGLD 1985) in Inches (if ramp had been built)	Water Depth at End of Ramp at Potential Extreme Low (574.3' IGLD 1985) in Inches	Water Depth at End of Ramp at Potential Extreme High (583.4' IGLD 1985) in Inches
<b>Wisconsin continued</b>					
<b>Manitowoc County</b>					
Manitowoc Marina	66	78	52	23	132
Red Arrow Park, Green Street	14	26	0	-29	80
Manitou Park	10	22	-4	-33	76
Vet's Park, Two Rivers	42	54	28	-1	108
27th Street, Two Rivers	3	15	-11	-40	69
Hika Park, County Road XX, Cleveland	18	30	4	-25	84
Two Creeks Town Park	3	15	-11	-40	69
<b>Milwaukee County</b>					
Grant Park	5	17	-9	-38	71
South Shore Park	48	60	34	5	114
McKinley Marina	72	84	58	29	138
<b>Ozaukee County</b>					
Port Washington Marina	60	72	46	17	126
<b>Sheboygan County</b>					
City Boat Ramp (Sheboygan)	28	40	14	-15	94
Kiwanis Park	8	20	-6	-35	74
Sheboygan River Boat Launch	8	20	-6	-35	74
Deland Lakefront Park	60	72	46	17	126
North Point Park	36	48	22	-7	102
Amsterdam Park	12	24	-2	-31	78

\*depth interpreted from WDNR web site posting

Note: the functional depth of 15" was used to determine if a launch ramp was still usable.

**Map 1. Boat Launches Usable and Unusable at August 2000 Lake Michigan Levels**



- Usable at August 2000 low water
- Unusable at August 2000 low water

**Note:** the functional depth of 15" was used to determine if a launch ramp was still usable.

Source: Planning & Zoning Center, Inc., 2000.





**Photo 6. Ramp unusable due to low Lake Michigan water level.**

Ramps were judged to be functional if the depth of water at the end of the ramp measured 15" or more. This figure was based on observations of ramps with relatively low depths that were still being used for launching and discussion with Prof. Edward Mahoney of MSU. At shallower depths, some craft may still be able to launch, such as personal watercraft or small rowboats and canoes. However, powerboats could suffer damages and due to potential propeller wash effects on the lake or river bottom, the ramps should be closed.

If Lake Michigan dropped to the same level as the record low in 1964 (576.7' IGLD 1985), some ramps would still be functioning in all counties studied. Muskegon County would still have 28" at four ramps, Kewaunee County would still have 28" at its Steel Street Point ramp and other ramps would have upward of 58" (Marina Island in St. Joseph and Sawyer Park in Sturgeon Bay). Some ramps would be dry at this level and about 23 ramps would not be functional (less than 15" water at end of ramp). This leaves 32 ramps still functioning, which suggests that consideration of the 1964 record low was made in the design of many ramps.

At progressively lower lake levels, the situation becomes more difficult, especially in Michigan, without extension of the ramps or dredging. At the potential, extreme low level (574.3' IGLD 1985) 48 of 55 ramps would be closed (less than 15" of water at the end of the ramp). See Map 2. While there would be no ramps open in Allegan, Muskegon and Ottawa Counties in Michigan, ramps would still be open in Berrien County. This is a long segment of Michigan shore without ramp

access. Apparently, there are plans for a new, modern ramp to be built in 2001 in Muskegon State Park. In Wisconsin, at the extreme low level, it is likely that some boats, especially the smaller ones would still be able to launch in all but Kewaunee County. Larger boats may still be able to launch in Door and Milwaukee Counties.

While most boaters might savor the possibility of very high lake levels, such an event might produce some unanticipated problems. Roads to some launch sites may become flooded. The authors suspect this to be the case in Grand Haven, Michigan and at some other drowned river mouth sites. The effect of waves during high water could be more of a problem at some launch areas than at lower water levels. Permanent docks could become covered with water. There could also be the same problem at some ramps with adjustable docks. It is still possible that the top of the ramp is too low for extreme high water. This may be more often the case where ramps are built in floodplain locations.

We attempted to evaluate the high water capacity of launch ramps. Table 16 shows the water depth at the end of the ramp at the extreme high water level of 583.4' (IGLD 1985). At that Lake Michigan level, the depth at the end of the ramps visited would range from 45" at Comuniversity Park in Brown County, Wisconsin to 138" at St. Joseph Marina in Benton Harbor, Berrien County, Michigan and Sawyer Park in Sturgeon Bay, Door County, Wisconsin. When photographs of launch ramps taken in August 2000 were examined and an estimate made of the capacity to operate at water levels 66" (5.5') higher, the 14 ramps listed in Table 19 and Map 3 were judged to have a high water problem. This leaves 41 ramps largely unaffected by high water. A point along the access roads to some of these ramps may be in jeopardy by high water, but this was not evaluated.

**Map 2. Boat Launches Unsusable at Extreme Low Water Levels**



**Note:** the functional depth of 15" was used to determine if a launch ramp was still usable.

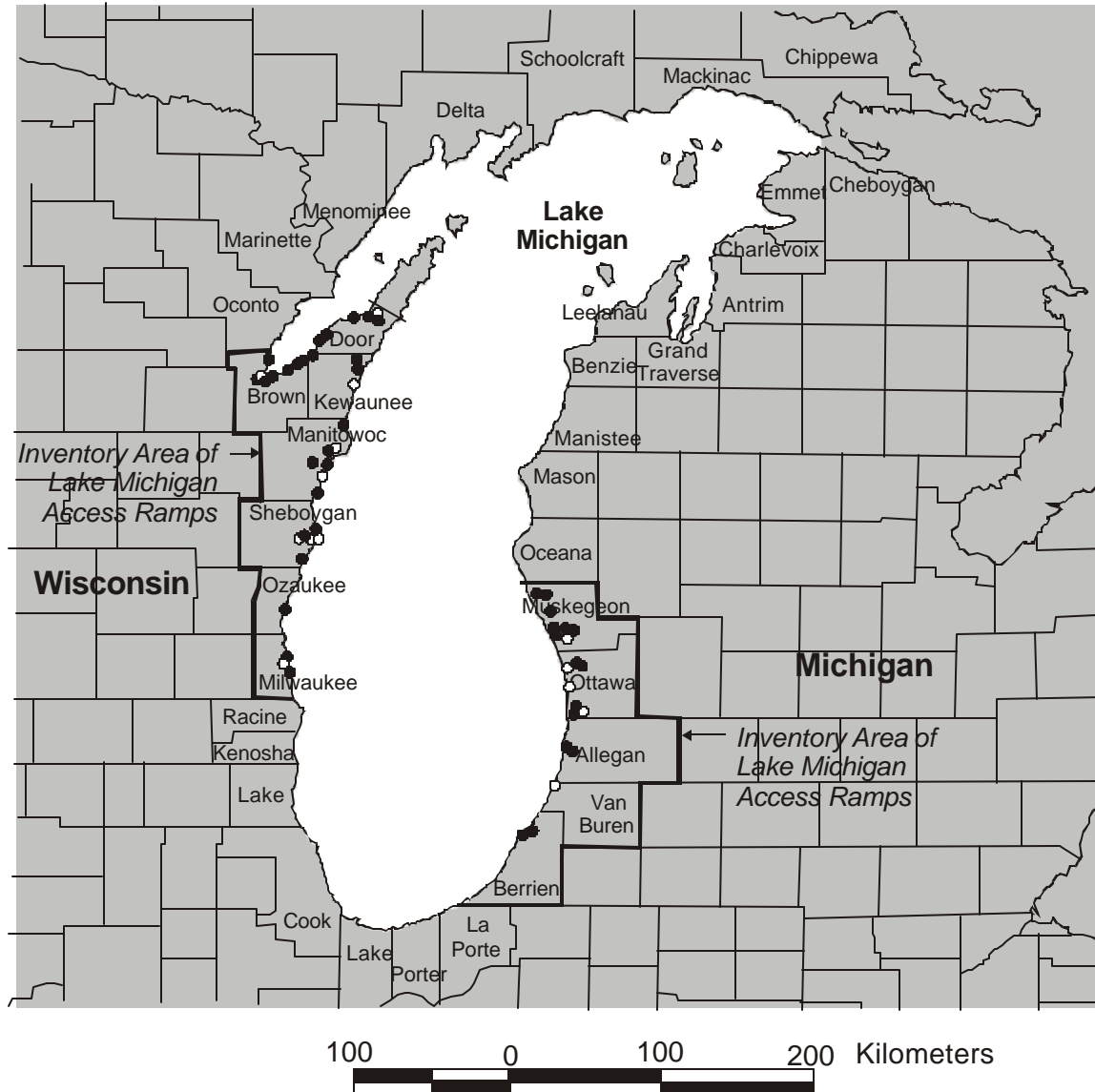
Source: Planning & Zoning Center, Inc., 2000.

**Table 19. Public Boat Launch Ramps with Potential Extreme High Water Problems**

<b>Public Launch Ramp</b>	<b>Location</b>
<i>Michigan</i>	
Hartshorn Marina	Muskegon Lake, Muskegon, Muskegon County
Mill Point Park	Spring Lake, Ottawa County
Grand Haven Municipal Ramp	Grand River, Ottawa County
Dunton Park	Lake Macatawa, Ottawa County
Black River Boat Ramp	Black River, South Haven, Van Buren County
<i>Wisconsin</i>	
South Shore Park	Lake Michigan, City of Milwaukee, Milwaukee County
Red Arrow Park	Lake Michigan, Manitowoc County
City Boat Ramp	Lake Michigan, City of Sheboygan, Sheboygan County
De Land Riverfront Park	Lake Michigan, City of Sheboygan, Sheboygan County
Kiwanis Park	Sheboygan River, City of Sheboygan, Sheboygan County
27 <sup>th</sup> Street Boat Ramp	East Twin River, City of Two Rivers, Manitowoc County
Kewanee Landing	Kewanee River, Algoma, Kewanee County
Sunset Park	Sturgeon Bay, City of Sturgeon Bay, Door County
Ashwaubomay Park	Fox River, near City of Green Bay in Brown County.

While floating or movable (extendable or retractable) docks are most often used to adjust for water level (see Photo 3), the pier at the Comuniversity Park launch ramp outside Green Bay, Wisconsin uses a more makeshift approach. As can be seen in Photo 4, wooden slats are attached to the side of the pier, extending above the top, to fend off boats during high water. This prevents the hulls from riding over the top of the pier.

**Map 3. Launch Ramps that May be Unusable due to High Water**



- Usable at extreme high water
- Unusable at extreme high water

**Note:** the functional depth of 15" was used to determine if a launch ramp was still usable.

Source: Planning & Zoning Center, Inc., 2000.



**Photo 7. Floating dock**



**Photo 8. Slats attached to pier at Comuniversity Park ramp near Green Bay, Wisconsin, probably to protect boats during high water. Note that in August 2000, the edge of the water is about twenty feet beyond the end of the ramp.**



Boat launches are important as an access opportunity to Lake Michigan. There are several questions in the different surveys that suggest how many boaters use boat launch ramps. In response to one EPIC MRA survey question, 55% of boaters engaging in boating in the pilot counties gain access through a boat launch (44% public boat launch, 9% private boat launch and 1% commercial boat launch--we don't know the difference between a private and commercial launch, these were the words of the respondent). The remainder store their boat in a marina or at the dock of a riparian property. Another EPIC MRA survey question asked where boat owners keep their boats, at a marina, waterfront residence or non-waterfront residence. This latter question may more accurately reflect the percentage of those who launch from ramps every time they boat. The first question may contain some bias for those who launch at a ramp at the beginning of the season, but then keep the boat in a marina slip or at a dock at their waterfront home. In the 1994 MSU survey, about 43% of boats were kept at non-waterfront homes in the Southwest region that includes Allegan County and 51% in the West Central region that includes Ottawa County.

We can estimate the potential for spending of those boaters who launch their boats from a trailer every time they go boating in Lake Michigan or a connecting body of water. Table 20 shows the estimated five-county total to range from about \$17 million to about \$24 million. For purposes of this estimate, the response rate from the EPIC MRA 2000 survey question regarding where the boat was kept was used in the calculation. Spending for trailered boats was estimated based on MSU 1998 data. Note that as in Table 5, this amount assumes that all trailerable boats in the respective counties were used the average number of boating days.

It is possible that some portion of the boating population may reduce their boating if water levels make some ramps unusable. Nearly two thirds (63%) of boaters surveyed always use the same launch site. Only 33% uses a variety of boat launches. While most boaters would likely travel to other launch sites, there is a segment that might resist.

While boaters appear to be loyal to certain boat launches, we were not sure which ones. The survey asked what sites they use most often out of those on a list of major public ramps. In Michigan 73% said "other" and 81% cited "other" in Wisconsin. It is possible that a portion of those indicating "other" did not recognize the ramp by the name used in the survey. Many boaters use pet names or unofficial names for boat launches and also for lakes.

### **Effect of Water Levels on Boating from Waterfront Properties**

There are many waterfront properties within the study counties that have private docks where boats are kept. These are generally private residences and not commercial marinas. A few may be condominium properties, but most are single family residences. According to the 1994 Boater Survey (Stynes, Wu and Mahoney), there were over 1,100 boats kept at waterfront homes in Allegan and

Ottawa Counties (these are the counties with drowned river mouth lakes in the pilot area). In the 2000 recreational boater survey, 28% of those using their boats in the five study counties kept their boats at a permanent waterfront residence, waterfront cottage or second home. This suggests that of 71,733 boats registered in the five counties, 20,085 boats would be kept at waterfront sites. If even half of those were large enough to use the Great Lakes, it would account for 10,000 boats kept at waterfront sites with access to Lake Michigan.

Virtually all individual, private docks within the study counties are on connecting waters such as rivers in Wisconsin (Sheboygan River and Twin Rivers) and drowned river mouth lakes (Lake Macatawa, Spring Lake, Kalamazoo Lake) and rivers (Grand River and Pigeon River) in Michigan. In Green Bay, Wisconsin, and on the Grand Traverse Bay in Michigan (both outside the pilot counties) there are Lake Michigan waterfront properties with individual, private docks. In these bays, the shorelines and docks are protected from the high energy waves of the open lake. Many of the docks in the protected bays are unusable during periods of low water or they require substantial extensions. This is due to low lake levels but the situation is exacerbated by long, shallow shelves. Observation during the relatively low, but not record low, levels of August 2000, confirmed this. Within the pilot counties, there were areas of Lake Macatawa and Kalamazoo Lake where water depth appeared to limit boating activity in 2000. It can be very expensive, often cost prohibitive to extend a private residential dock the length needed to float a boat during periods of low water. A study of the bottom topography indicates further limitations if the level should drop to the extreme potential low of 574.31' IGLD 1985. See Figure 1. With the shoreline extended beyond the docks of marinas and shoreline property owners, these lakes could be unavailable to large power boats, sailboats with fixed keels--anything larger than a canoe.

The loss of dock use along connecting rivers in the pilot counties in Wisconsin may be slight. The level of this use is not very extensive. The primary access to Lake Michigan in Wisconsin is from marinas and boat ramps. Also, river channels can be deep close to shore, further minimizing the effects of lowered water levels.

One of the problems with docks in general and private docks in particular is that the relationship of the top of the dock to the water level can fluctuate so much that it becomes difficult to enter and exit boats tied to the docks. This can also lead to damage of the boats if they either ride up over the docks during high water or the decks bump against the under side of the dock during low water. Floating docks are a solution to this but are more common at public and private marinas.

Many of the private docks are at waterfront properties on drowned river mouth lakes on the Michigan side of Lake Michigan. About half the drowned river mouth lakes providing access to Lake Michigan are located within the pilot counties and



adjacent counties studied for this FY 2000 report. There are only a few others in the remaining 22 counties. However, there are extensive reaches of Lake Michigan shoreline in protected bays where there can be waterfront docks.

**Table 20. Trailer-Launched Boat-Related Spending in Five Lake Michigan Counties**

Estimated Trailer Launched Boat Spending Based on EPIC MRA 2000 Boating Survey

State/ County	Estimated Number of Boats Used on Great Lakes Waters	Estimated Number of Boats Trailer- Launched on Great Lakes Waters	Average Days of Use	Estimate of Boating Days per County	Boating- Related Trip Spending per County @\$35	Seasonal Expenses per County @\$427	Total Spending Year 2000
Michigan		43%					
Allegan	6,187	2,660	26	69,171	\$2,420,973	\$2,641,849	\$5,062,822
Ottawa	13,367	5,748	26	149,443	\$5,230,507	\$5,707,709	\$10,938,216
Wisconsin		51%					
Manitowoc	3,220	1,642	23	37,771	\$1,321,971	\$1,374,940	\$2,696,911
Ozaukee	2,499	1,274	23	29,313	\$1,025,964	\$1,067,073	\$2,093,037
Sheboygan	4,010	2,045	23	47,037	\$1,646,306	\$1,712,270	\$3,358,576
<b>Total</b>	<b>29,283</b>	<b>13,371</b>		<b>332,735</b>	<b>\$11,645,721</b>	<b>\$12,503,841</b>	<b>\$24,149,562</b>

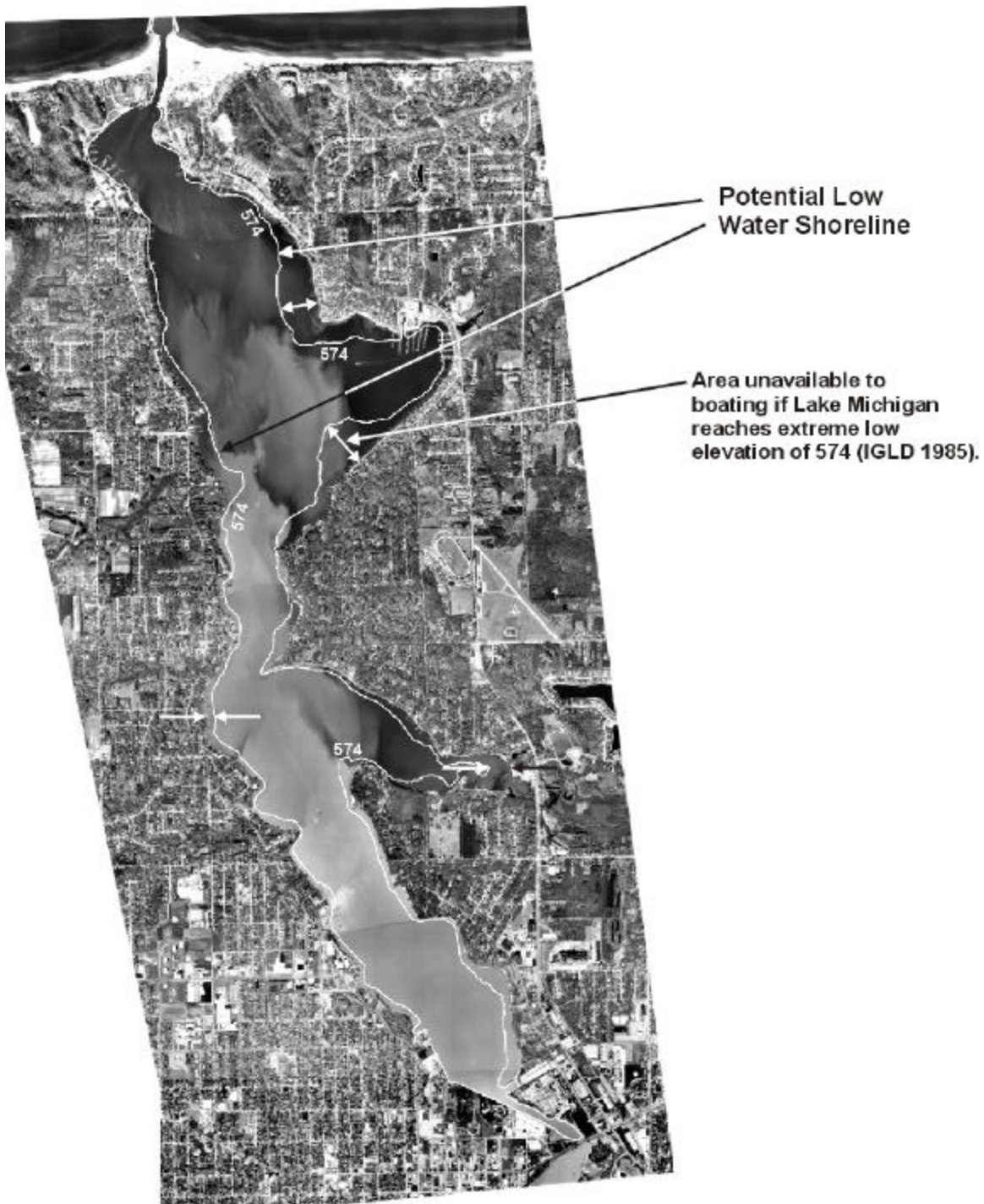
Estimated Trailer Launched Boat Spending Based on MSU 1994 Boating Survey

State/County	Estimated Number of Boats Used on Great Lakes Waters	Estimated Number of Boats Trailer- Launched on Great Lakes Waters	Average Days of Use	Estimate of Boating Days per County	Boating- Related Trip Spending per County @\$35	Seasonal Expenses per County @\$427	Total Spending Year 2000
Michigan		43%					
Allegan	6,187	2,660	7	18,623	\$651,800	\$2,641,849	\$3,293,649
Ottawa	13,367	5,748	13	74,722	\$2,615,254	\$5,707,709	\$8,322,963
Wisconsin		51%					
Manitowoc	3,220	1,642	9	14,780	\$517,293	\$1,374,940	\$1,892,233
Ozaukee	2,499	1,274	9	11,470	\$401,464	\$1,067,073	\$1,468,537
Sheboygan	4,010	2,045	9	18,406	\$644,207	\$1,712,270	\$2,356,477
<b>Total</b>	<b>29,283</b>	<b>13,371</b>		<b>138,001</b>	<b>\$4,830,018</b>	<b>\$12,503,841</b>	<b>\$17,333,859</b>

Note: Estimate of number of trailer-launched boats based on number of registered boats  $\geq 16'$  and EPIC MRA survey response.

Spending for trips and seasonal expenses from Stynes, et al, 1998.

**Figure 1. Air Photo of Lake Macatawa with Potential Extreme Low Elevation of 574.31' IGLD 1985 Superimposed**



## SUMMARY

The following discussion highlights the findings of the study.

There is a substantial financial loss to recreational boating with a decline in Lake Michigan water level. This loss has three main components:

- Loss specific to marinas: It is possible to demonstrate a financial loss to marinas in the five study counties of between \$2 to \$4 million. These are estimates but are based in part on fairly exact record-keeping of marina owners and on observable numbers of marina slips.
- Loss of trip-related spending in the community due to a loss of available marina slips. There was no loss estimated in 2000 because the loss of slips due to low water equaled the excess capacity of marinas. If water levels were to drop an additional 12", this loss would be about \$825,000 in Allegan and Ottawa Counties and the loss would be about \$1.15 million for a drop of 18". There would be no such loss in Wisconsin.
- General loss to a potential boating-related economy. We gathered information on the level of boating activity in 2000, including average boating days, use of trailer launched boats, boat launch ramp depth capacity, charter fishing and boat sales. However, it was difficult to develop a stage damage curve for future financial impact. This was because of the difficulty of gaining an accurate response from boaters on their likely change in boating activity due to a situation they have never encountered. Therefore, we've estimated the potential boating-related spending that low waters could affect. How much low water affects spending is open to further speculation. We believe that the boating-related economy of the five counties could be in range of about \$29 million to as high as nearly \$43 million.

If all boat owners in the pilot counties use their boats the average number of days reported and spend the average amount for their county per boating day, then boater spending will be quite large. See Table 5. The potential economic impact of boating could be \$29 to \$43 million in the five-counties.

Note that we have used averages for spending figures. It would be possible to segment spending by boat range. We know how many boats of the different sizes are registered in the different counties and the owners of boats in the different ranges spend differently. However, this would suggest a greater level of accuracy in the resulting figure than the survey techniques justify.

This study looked at potential economic loss associated with high water as well. This proved impossible to quantify. The difficulties in doing so may be due to the focus of the boating industry and recreational boaters on low water. It was just impossible for them to seriously engage the idea of high water being anything other than a miracle. They may be asking, when is having too much water to float a boat a problem? It is when marinas have to raise fixed docks and when access to certain marinas and boat launches becomes impossible due to flooded roads

and parking lots. Perhaps there would be an offsetting gain from increased boat sales, but this is conjecture.

This study found that there was:

- A large economic loss to marinas in Michigan. This was estimated at \$2 million in the three Michigan pilot counties in 2000. At lower Lake Michigan levels this loss would rise to \$3 million and \$4 million with lake level drops of 12" and 18" respectively from 2000 levels.
- If the level of Lake Michigan continued to drop, the resulting loss of marina slips could result in a decline of trip-related spending in Ottawa and Allegan Counties of \$0.825 million for a 12" drop below 2000 levels and \$1.15 million for an 18" drop below 2000 levels.
- Little loss to Wisconsin marinas. Marinas in Wisconsin seem well prepared to deal with low water. They are generally located in boat basins constructed directly on the Lake Michigan shoreline. They also, generally, employ floating docks. A sufficient depth to accommodate low water appears to be maintained. This could be due either to dredging or a lack of silt build-up.
- A loss of spending due to a reduction in boating days in both states. While it appears that the number of days people go boating in these counties is up substantially from the early 90s when MSU completed its survey, the EPIC MRA survey in 2000 reported that 42% of respondents boat somewhat less to much less now than two or three years ago. Of that group, only 19% report the reason is low water levels. Forty-five percent reported less free time as the main reason they boated less than a few years ago. However, when the survey asked about the affect of water levels approaching the projected extreme low, the response jumps to 76% citing a minor to major impact of declining water levels and 89% a minor to major impact if the water level dropped a foot. If water levels dropped two feet below 2000 levels the response was 95% a minor to major (86%) impact.
- Small loss to charter fishing boats. To some degree, charter boats can move their home port from a marina with low water problems to one with better access. Most of the loss of business experienced by charter boats in 2000 was due more to poor weather than low water. Still, 17% of charter boat operators surveyed reported low water impacts. Oddly, 43% reported knowing of at least one other boat operator that experienced a low water impact.
- Some increase in boat repair costs. This was difficult to quantify because the record keeping of repair shops does not routinely account for damage causes. Repair facilities reported no increase in business but due to an overall drop in boating, we suspect repairs due to low water may have made up a larger portion of their business. EPIC MRA survey respondents cited repairs in 2000 averaged about \$218.
- A reduction in the number of boat launch ramps that remain usable at extreme high and low water levels. However, generally, there will be a usable ramp within a reasonable driving distance from most anywhere on the Lake Michigan coast (pilot counties). This depends upon what a boater considers reasonable. There was no specific question about this in the 2000 survey. We

assumed about an hour drive. The exception to ramp availability may be the Michigan coast with only one ramp remaining open between northern Muskegon County and the state line of Berrien County at extreme low water. This ramp is in northern Berrien County. While it is one of the higher capacity ramps, it could become crowded if several thousand boaters find it to be the only launch ramp available for access to Lake Michigan. Spending related to trailered boats was estimated at between \$17 million and \$24 million in 2000 in the five counties.

In Michigan, a separate research project estimated overall loss to Great Lakes marinas due to low water at \$11.8 million in 1999. (Mahoney, Tzu-Ching, Pistis and Martin, 2000) This separate study was state-wide, and not conducted in Wisconsin.

## CONCLUSIONS

The following conclusions were developed by the consultant, Planning & Zoning Center, Inc. with help from Professor Edward Mahoney of MSU (italics):

*The results of this and another study also conducted in 2000 (Mahoney, et. al, 2000) indicate that low water levels continue to have a negative impact on recreational boating especially a financial effect on Michigan marinas. If water levels in Ottawa and Allegan Counties fall an additional 12" it will have a catastrophic impact on many of the marinas serving Lake Michigan boaters and this in turn will reduce boat sales and negatively impact local businesses that sell products and services to boaters including the local tourism industry. The impacts of low water levels on charter fishing are not as dramatic although some charter fishing operations suffered from inconveniences (e.g., relocation to other marinas) and higher costs. Estimating the negative economic impacts attributable to low water was made more difficult because weather conditions and higher fuel prices also impacted on recreational behavior and participation throughout most of the 2000 boating season.*

*The impacts of low water are significantly greater in Michigan than Wisconsin in part because Michigan has more marinas that are located on or depend on rivers and channels for boating access, more of the Wisconsin marinas have floating rather than fixed docks, and many of the marinas in Michigan have not adequately incorporated fluctuating water levels as part of their design and operations. It will be important to continue to educate marina operators on design approaches and technologies that can avoid or mediate the negative impacts of fluctuating water levels. Consideration should be given to a low interest loan program and/or tax incentives that encourage investments that mediate the negative impacts of fluctuating water levels on marinas.*

*It is important to recognize that many Great Lake's marinas are very small businesses and the combined effects of low water, unfavorable weather*

*conditions, and higher gasoline prices were traumatic and in some instances fatal to a number of them. A number of the marina businesses in Michigan that we surveyed likely will not open next year whether or not 2001 water levels are higher than 2000. They were unable to absorb the combined impact of reduced revenues (i.e., slippage rental, gasoline sales) and increased cost (i.e., dredging, repairs). The long-term concern is that a majority of the marinas that go out of business are converted to other land-uses (e.g., residential and commercial development), rather than being continued as marinas with different owners.*

*In some instances boat access to marinas was restricted or completely eliminated because the river or channel that provides access was not dredged. In a number of situations marinas performed dredging inside the marinas only to find that the river or channel that provides boating access was inaccessible because it was not dredged. It will be important that agencies and organizations that fund and approve dredging develop a dredging schedule and make that available to boating businesses.*

*There needs to be more consistent and supportive approaches across various agencies to facilitate acquisition of dredging permits. Many of the marinas complained that the process was still confusing and frustrating. In some instances, this prevented some marinas from obtaining dredging permits, or from obtaining them early enough so they were able to secure a dredging contractor.*

*There is clearly a need for a more integrated, collaborative and pro-active approach to dealing with water levels. The partners should include the Parks and Recreation Bureau of the Michigan Department of Natural Resources, Michigan Department of Environmental Quality, US Army Corps of Engineers, Michigan Boating Industries Association, and local units of Government. Emphasis should be placed on establishing and responding to dredging priorities, educational efforts aimed at making boating businesses and agencies better prepared to deal with fluctuating water levels, and financial programs to encourage investment in fluctuating water level marina design, infrastructure and operational enhancements. Recreational boating businesses should be more aware of information (e.g., projections) on water levels.*

*There is a critical need to continue to conduct additional research to better understand the potential impacts of fluctuating water levels on marinas and public access (launch) sites on the Great Lakes. There needs to be a continuing coordinated effort to:*

- Identify and profile Great Lakes marinas and evaluate their vulnerability to fluctuating water levels*
- Better understand Great Lakes boater behavior and likely response to changes in boating opportunities*
- Estimate the economic impacts of different levels of boating activity on local communities.*

*It will be important that public agencies partner with boating businesses to develop and disseminate information about water levels and the resultant impact on boating facilities and services. It appears that some of the negative impacts experienced by recreational boating businesses were the result of incomplete or inaccurate information about water levels affects on boating facilities and services.*

### **Improvements for Future Research**

As this type of study is replicated in other counties or on the larger scale of a whole Great Lake basin, the following improvements in the method are proposed:

- Provide repair facilities with a survey recording instrument that identifies repairs due to low water. For example, this could be a form that is faxed by the surveyor to the repair facility on a regular basis.
- When conducting the inventory of boat launch ramps, measure or observe for potential high water problems. This would include the ramp, access roads and parking.
- Include private launch ramps if feasible. Unfortunately, this could extend the cost of the ramp inventory in the remaining 22 counties to an unreasonable amount. There is some expertise involved in the inventory. The ramp inventory compiles information both on the location of ramps and on capacity to launch at different water levels. The measurement of water level capacity should follow the same method among all ramps. Ideally it would be conducted by the same person. The public ramp inventory conducted in August 2000 duplicated an inventory conducted earlier the same year by the Michigan Department of Natural Resources of Michigan public ramps. While the MDNR did not want its figures released, they were available to the consultant. Consultant measurements were not in complete agreement with those of the DNR. There were inconsistencies and we believe it may be because different people may have taken the DNR measurements. Therefore, an inventory of private ramps should not rely on the many owners of the private ramps to take measurements.
- Try to obtain an estimate of change in boating days due to low water that screens our variation from bad weather and reduced time to go boating. This may require some sophisticated survey design, but would be helpful in narrowing the potential damages estimates of low water.
- Survey a larger sample of registered boat owners so that a stronger link between a change in boating days and spending related to boating craft and trips can be made.
- Ask in the survey of registered boat owners whether size of the boat influences trips out into the big lake. There is some relationship between boat size and spending patterns. It may be possible to infer the relationship from the screening questions, but a larger sample may permit asking this directly.
- Survey marinas for the maximum lake elevation that their docks and access areas (drives and parking) could withstand before dock alterations would be necessary or marina operations affected.

- In the survey of recreational boat owners, ask how far they would be willing to trailer their boat to find a usable launch ramp with access to Lake Michigan. We assumed they would accept an hour drive, but the critical distance and time could be greater or smaller. Also try to gain some estimate of how much crowding boaters would endure at launch ramps before they would limit boating activity. This is important because as water levels declined, fewer ramps would remain usable for larger boats.

### **How to Use the Results**

The following ideas are presented as thoughts on what to do with the information collected in this study:

- The results are instructive for the Wisconsin boating industry in that they have prepared well for fluctuating natural conditions. They should look at other potential factors that could affect boating and become prepared. One such factor is the potential extreme high water impacts on public launch sites.
- The boating industry in Michigan should evaluate the economic impact of being poorly prepared to deal with the vagaries of nature. Much of the loss to recreational boating in the Michigan pilot counties is due to poor planning and could have been avoided. It has been only a little over thirty years since Lake Michigan was very low and that was another 14" below 2000 levels. Michigan marinas are suffering, even going out of business, because they didn't plan for the absolutely certain change in lake level. Public boat ramps that will be closed due to lake level fluctuation could have been designed with deeper capacity in low water and access roads could have been built to remain open if Lake Michigan reaches an extreme high water level.
- Michigan marinas may be poorly located. In some counties, they would be better situated close to the river mouths or out on the shore of the big lake (protected by breakwaters although this raises sand transport issues). Access from many of the existing marinas requires boats to travel a long distance along dredged channels. These channels are in areas that tend to accumulate sediments. The same is true of the marinas themselves. Dredging at individual marinas appears to be insufficient by itself to provide access to Lake Michigan. Not only do marinas need to dredge out their own basins, they need to have main and side channels dredged through shallow areas of the drowned river mouth lakes. Marinas on the same body of water need to work with local units of government, the state and federal governments to be prepared for changing conditions. They also should be working to prevent sedimentation in the upper reaches of the watersheds that is then carried to the river mouth lakes where it rapidly fills dredged channels and marina basins. Some sedimentation is natural, the amount depending on soil types in the watershed. However, in many watersheds, human activity accounts for most of the sediment load. The alternative to dealing with ongoing sedimentation is to relocate marinas to sites with fairly dependable access to the big lake.
- Dredging should continue during high water phases in preparation for the next period of low water. Sedimentation will continue even during the next high



water phase. If unprepared, marinas and boat launches could be in trouble when lake levels drop again.

- The boating industry should consider very carefully the perception of boaters about water levels. In 2000, when there was substantial economic harm to the boating industry due to low water, only 19% cite low water as the reason they were boating less than a few years ago and 42% reported boating somewhat less or much less. However, when asked to think about water levels two feet lower (which is still above the projected extreme low), 95% believe there will be a significant impact to boating. Even with high demand, there could be a substantial drop-off in the number of people who go boating or buy boats as the media calls attention to low water.

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## **APPENDIX A: MARINA SURVEY FORM**

# **ARMY CORPS ENGINEERS WATER LEVEL IMPACT STUDY**

Marina/Facility: \_\_\_\_\_ Number of wet slips: \_\_\_\_\_ Person completing the survey: \_\_\_\_\_  
 County where marina is located: \_\_\_\_\_

1. Did low water levels adversely affect your marina this year?

☐ No (go to question 2)

☐ Yes (Check ☐s to indicate types of impacts, and then for each impact provide other information (e.g., slips lost, cost of dredging))

<input type="checkbox"/> Unusable wet slips?	# of slips: _____	Lost revenues: _____	Describe the impacts in more detail
<input type="checkbox"/> Wet slips that could not handle the size boats they were designed for	# of slips: _____	Lost revenues: _____	
<input type="checkbox"/> Dredging due to low water	# yards removed: _____	Cost: _____ (removal, disposal, consulting)	
<input type="checkbox"/> Damage to docks, piers, breakwalls – Replacement & Repairs		Cost: _____	
<input type="checkbox"/> Inaccessible (e.g., fuel facilities, pump-outs, launch sites) Which Facilities: _____		Lost Revenue/Cost \$: _____	
<input type="checkbox"/> New or Rebuilding Facilities (e.g. docks, walkways) Which Facilities: _____		Cost: _____	
<input type="checkbox"/> Other impacts/damage/loss: _____		Cost: _____	

2. What will be the impacts and costs to your marina if water levels are 12" or 18" lower than current levels?

☐ There would be no negative impact (go to question 3)

**Answer for both a 12" and 18" drop in water levels**

Check the ☐s to indicate impacts

	If water is 12" lower than last year		If water is 18" lower than last year	
<input type="checkbox"/> Unusable wet slips	# of slips: _____	Lost revenues\$: _____	# of slips: _____	Lost revenues\$: _____
<input type="checkbox"/> Wet slips that will not handle the size boats they were designed for	# of slips: _____	Lost revenues\$: _____	# of slips: _____	Lost revenues\$: _____
<input type="checkbox"/> Dredging	Yards needing removal _____	Cost: _____ (removal, disposal, consulting)	Yards needing removal _____	Cost: _____ (removal, disposal, consulting)
<input type="checkbox"/> Damage to docks, piers, breakwalls – Replacement & Repairs	What damage? _____	Cost: _____	What damage? _____	Cost: _____
<input type="checkbox"/> Facilities that will be inaccessible (e.g. launch sites, fuel stations)	What Facilities? _____	Cost: _____	What Facilities? _____	Cost: _____
<input type="checkbox"/> New or required rebuilding of facilities (e.g. docks, walkways)	What Facilities? _____	Cost: _____	What Facilities? _____	Cost: _____
<input type="checkbox"/> Other impacts/damage	Damage: _____	Cost: _____	Damage: _____	Cost: _____

3. Did you dredge your marina in 2000?

☐ Yes → 3a. How many yards were removed? \_\_\_\_\_ Estimated dredging cost (including removal, disposal)? : \_\_\_\_\_  
 Go to question 4

☐ No (go to question 4)

4. Did you dredge your marina in 1999?

☐ Yes → 4a. How many yards were removed? \_\_\_\_\_ Estimated dredging cost (including removal, disposal)? : \_\_\_\_\_

☐ No → 4b. What was the last year you dredged? \_\_\_\_\_ Yards removed? \_\_\_\_\_ Dredging cost (including removal, disposal) \_\_\_\_\_

5. Would a rise in water levels 12" above current water levels have any negative impacts on your marina?

☐ No (Go to question 6)

☐ Yes (Check ☐s to indicate types of impacts, and then for each impact provide other information (e.g., slips lost, cost of dredging))

<input type="checkbox"/> Unusable wet slips? # of slips: _____	Lost revenues: _____	Describe the impacts in more detail
<input type="checkbox"/> Wet slips that could not handle the size boats they were designed for # of slips: _____	Lost revenues: _____	
<input type="checkbox"/> Damage to docks, piers, breakwalls – Replacement & Repairs	Cost: _____	
<input type="checkbox"/> Inaccessible (e.g., fuel facilities, pump-outs, launch sites) Which Facilities: _____	Lost Revenue/Cost \$: _____	
<input type="checkbox"/> New or Rebuilding Facilities (e.g. docks, walkways) Which Facilities: _____	Cost: _____	
<input type="checkbox"/> Other impacts/damage/loss: _____	Cost: _____	

6. Would a rise in water levels 24" above current water levels have any negative impacts on your marina?

☐ No → 6a. How much higher would water levels have to rise above current levels to have a negative impact on the marina? \_\_\_\_\_".

☐ Yes (Check ☐s to indicate types of impacts, and then for each impact provide other information (e.g., slips lost, cost of dredging))

<input type="checkbox"/> Unusable wet slips? # of slips: _____	Lost revenues: _____	Describe the impacts in more detail
<input type="checkbox"/> Wet slips that could not handle the size boats they were designed for # of slips: _____	Lost revenues: _____	
<input type="checkbox"/> Damage to docks, piers, breakwalls – Replacement & Repairs	Cost: _____	
<input type="checkbox"/> Inaccessible (e.g., fuel facilities, pump-outs, launch sites) Which Facilities: _____	Lost Revenue/Cost \$: _____	
<input type="checkbox"/> New or Rebuilding Facilities (e.g. docks, walkways) Which Facilities: _____	Cost: _____	
<input type="checkbox"/> Other impacts/damage/loss: _____	Cost: _____	

7. Did water levels impact your business this year (2000) in ways not covered in Question #1. Please describe these impacts?

THANK YOU AND PLEASE COMPLETE AND FAX YOUR RESPONSE TO: Ed Mahoney, Michigan State University: 517.432.3597

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## **APPENDIX B: CHARTER FISHING SURVEY FORM**

## ARMY CORPS ENGINEERS WATER LEVEL IMPACT STUDY

Charter Boat \_\_\_\_\_ Date \_\_\_\_\_

Person interviewed \_\_\_\_\_ Interviewer \_\_\_\_\_

Michigan State University is conducting a study for the U.S Army Corps of Engineers to determine the impact of low water levels on boating and charter fishing businesses in Wisconsin and Michigan. We are attempting to estimate the economic impact on these businesses to assist the Army Corps in developing policies and programs. We have only a couple of questions to ask that should take about 10 minutes.

### 1. Were you charter fishing business impacted negatively this year due to low water levels?

☐ Yes -->

☐ No



#### 1a. What were impacts?

☐ Fewer charters \_\_\_\_\_ # of charters \$ \_\_\_\_\_ lost revenues

☐ Slips unavailable

☐ Had to move to a different marina

☐ Had to move to a different port

☐ Had to move to a different lake

\$ \_\_\_\_\_ Additional slip cost for different slip

Customer inconvenience \_\_\_\_\_

☐ Damage to boat \$ \_\_\_\_\_

☐ Other Impacts \_\_\_\_\_

### 2. Did low water levels have a negative impact on any other charter fishing boats in your area?

### 3. Did low water levels have any negative impacts on boating businesses in you area?

## **APPENDIX C: DEALER SURVEY FORM**



**ARMY CORPS ENGINEERS WATER LEVEL IMPACT STUDY**

**Dealer business name:**

**Person completing the survey:**

**Calling date:**

**1. Did you sell more or less watercraft this year than last year?**

☐ 1a. Same number of boats as last year

☐ 1b. More -- What percentage increase? \_\_\_\_\_

What do you think contributed to the increase in sales?

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☐ 1c. Less -- What percentage decrease? \_\_\_\_\_

☐ What factors contributed to the decrease in sales?

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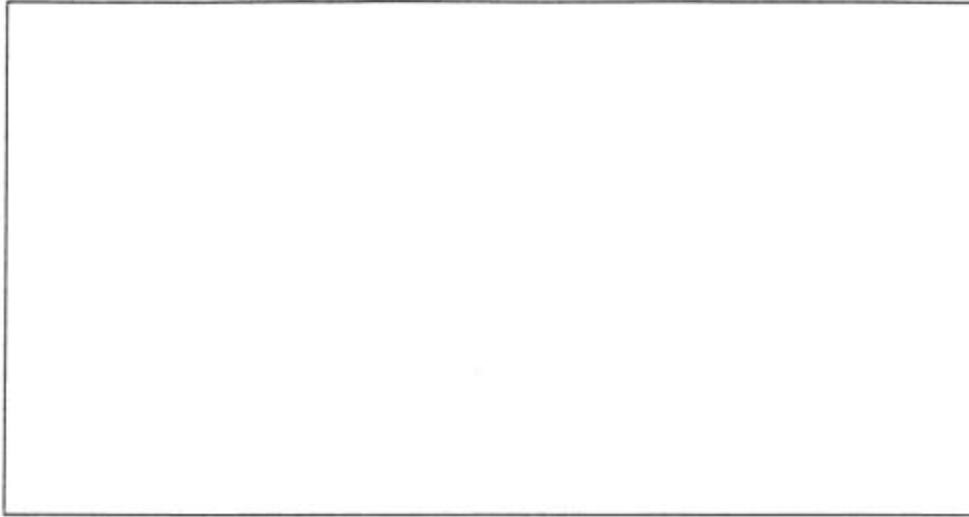
☐ Were water levels a factor in decreased sales? \_\_\_\_\_

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2. Did low water levels have any impacts on boating activity or boating businesses in your area?



## **APPENDIX D: PHONE SURVEY EXECUTIVE SUMMARY**

# **Survey of Lake Michigan Boaters Living in Specific Michigan & Wisconsin Counties**

## **EXECUTIVE SUMMARY and DEMOGRAPHIC ANALYSIS**

**December 9, 2000**

## METHODOLOGY

**EPIC MRA** administered interviews with 451 registered boaters living in specific counties in Michigan (Ottawa or Allegan counties), or Wisconsin (Manitowoc, Ozaukee, or Sheboygan counties). Interviews were conducted between October 29 and November 14, 2000. Respondents were included in the survey if they appeared on a randomly drawn sample of registered boat owners from Michigan or Wisconsin, and have used their registered boat in the past three years.

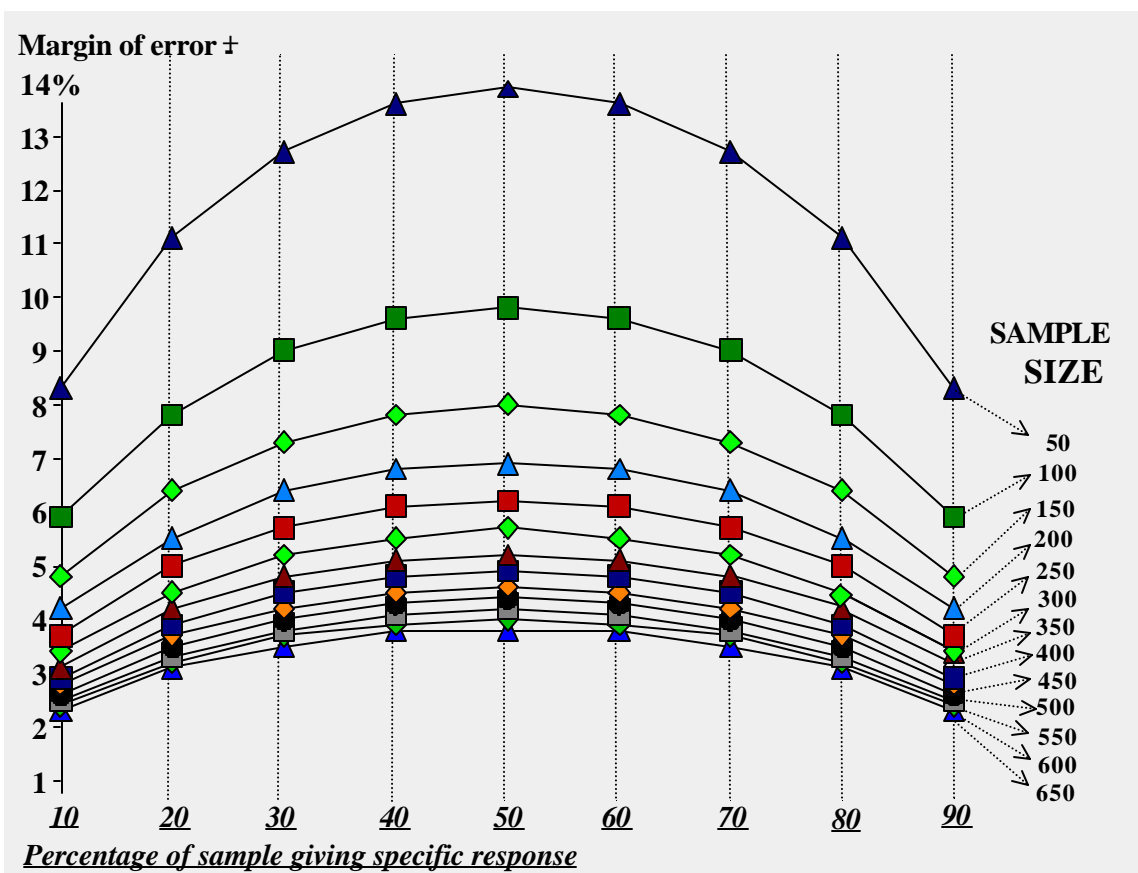
In interpreting survey results, all surveys are subject to error; that is, the results of the survey may differ from those which would have been obtained if the entire populations were interviewed. The size of the sampling error depends on the total number of respondents in the particular question. The table below represents the estimated sampling error for different percentage distributions of responses based on sample size.

For example, 49 percent of all 451 respondents said they have one boat that is registered in their name (Question #3). As indicated in the chart below, this percentage would have a sampling error of plus or minus 4.6 percent. That means that with repeated sampling, it is very likely (95 times out of every 100), that the percentage for the entire population would fall between 44.4 percent and 53.6 percent, hence 49 percent  $\pm 4.6$  percent.

EPIC MRA

**Sampling Error By Percentage (At 95 In 100 Confidence Level)***Percentage of sample giving specific response*

	<u>10</u>	<u>20</u>	<u>30</u>	<u>40</u>	<u>50</u>	<u>60</u>	<u>70</u>	<u>80</u>	<u>90</u>
<b>SAMPLE SIZE</b>	<b>% margin of error ±</b>								
<b>650</b>	2.3	3.1	3.5	3.8	3.8	3.8	3.5	3.1	2.3
<b>600</b>	2.4	3.2	3.7	3.9	4	3.9	3.7	3.2	2.4
<b>550</b>	2.5	3.3	3.8	4.1	4.2	4.1	3.8	3.3	2.5
<b>500</b>	2.6	3.5	4	4.3	4.4	4.3	4	3.5	2.6
<b>450</b>	2.8	3.7	4.2	4.5	4.6	4.5	4.2	3.7	2.8
<b>400</b>	2.9	3.9	4.5	4.8	4.9	4.8	4.5	3.9	2.9
<b>350</b>	3.1	4.2	4.8	5.1	5.2	5.1	4.8	4.2	3.1
<b>300</b>	3.4	4.5	5.2	5.5	5.7	5.5	5.2	4.5	3.4
<b>250</b>	3.7	5	5.7	6.1	6.2	6.1	5.7	5	3.7
<b>200</b>	4.2	5.5	6.4	6.8	6.9	6.8	6.4	5.5	4.2
<b>150</b>	4.8	6.4	7.3	7.8	8	7.8	7.3	6.4	4.8
<b>100</b>	5.9	7.8	9	9.6	9.8	9.6	9	7.8	5.9
<b>50</b>	8.3	11.1	12.7	13.6	13.9	13.6	12.7	11.1	8.3



## Executive Summary

- Low water levels have already become a significant problem among boat owners in both Michigan and Wisconsin. Overall, 29 percent cited low water levels as the most important problem confronting boaters.
  - 32 percent among Wisconsin resident respondents and 26 percent in the Michigan subsample cited this as the biggest problem.
- When respondents who had not cited low water levels as their top problem in the open ended question were specifically asked if Lake Michigan water levels have dropped, remained the same or increased, more than nine-in-ten said water levels have dropped.
  - Overall, respondents said they thought water levels had dropped about two and two-thirds feet over the past two or three years.
- More than four-in-ten respondents said Lake Michigan boaters had used their boats less over the two or three years because of the drop in water levels.
  - Forty-six percent of Wisconsin respondents and 36 percent of Michigan respondents said boaters are using their boats less because of the drop in water levels.
- A third of all respondents said declining water levels have already had a major economic impact on boating, resulting in a drop in boating, a negative impact on tourism, the closing of some marinas and less commercial fishing.
  - Concern about the economic impact of current low water levels is higher in the Michigan subsample, with 38 percent of Michigan respondents saying low water levels will have a major economic impact on boating, as opposed to 28 percent of Wisconsin respondents saying the same.
- Two-thirds of respondents overall said if Lake Michigan water levels were to drop by about a foot over the next few years, there would be a major economic impact on boating, and more than a third said they would have to seek alternative launch sites.
  - Sixty-four percent of Michigan respondents and 71 percent of the Wisconsin subsample said a one-foot drop would have a major economic impact
  - Thirty-seven percent of Wisconsin respondents and 31 percent of the Michigan subsample said they would have to seek alternative launch sites.
- Almost nine-in-ten (86 percent) of respondents overall said if Lake Michigan water levels were to drop by two feet over the next few years, there would be a major economic impact on boating; in this scenario, almost half said they would have to seek alternative launch sites.
  - An 87 percent majority of Wisconsin respondents and an almost identical 85 percent of the Michigan subsample said a two-foot drop would have a major economic impact

- Forty-three percent of Michigan respondents and 52 percent of the Wisconsin subsample indicated they would have to seek alternative launch sites if there were a two-foot drop.
- Exactly nine-in-ten respondents said a drop of three feet in water level would have a major economic impact — causing a drop in boating, limited access to ports, the closing of some marinas and difficulty launching — while nearly six-in-ten said they would have to seek alternative launch sites if waters dropped by this much.
  - Eighty-nine percent of Michigan respondents and 90 percent of the Wisconsin subsample said a three foot drop would have a major economic impact.
  - Fifty-six percent of the Michigan subsample and 54 percent of Wisconsin respondents said they would have to seek alternative launch sites with a three-foot drop in water levels.
- Respondents were asked to evaluate the impact on boating if Lake Michigan water levels increased about five feet, or about a foot over the previously recorded high levels in 1986. Here, three-in-ten said this scenario would have a major economic impact, resulting in water over the docks, beach erosion, added cost for raising docks and more boat traffic.
  - Thirty-four percent of Wisconsin respondents and 26 percent of the Michigan subsample said higher water levels would have a major economic impact on boating.
  - Nine percent of Michigan respondents and six percent of the Wisconsin subsample said a five-foot increase would force them to seek alternative launch sites.
  - Clearly, boaters from both states view high water levels as a problem, but not as great a problem as low water levels.

## Boat types

More than half of the survey respondents have more than one boat registered in their name, with 20 percent of the sample having three or more registered boats. Almost 55 percent of Michigan boaters and 48 percent of Wisconsin boaters have more than one boat.

Almost a third of all respondents (31 percent) reported ownership of an inboard/outboard motorboat, 22 percent each have a powered sailboat or an outboard motorboat, 17 percent have an inboard motorboat, seven percent a pontoon boat and one percent an unpowered sailboat. In comparing the two state subsamples, the big difference is in the larger number of powered sailboats in Michigan and of outboard motorboats in Wisconsin.

- In Michigan, the breakout was: 32 percent powered sailboat, 29 percent inboard/outboard motorboat, 18 percent inboard motorboat, 13 percent outboard motorboat, seven percent pontoon boat and one percent an unpowered sailboat.



- In Wisconsin: 32 percent inboard/outboard motorboats, 31 percent outboard motorboats, 17 percent inboard motorboats, 12 percent powered sailboats, seven percent pontoon boats, and one percent unpowered sailboats.
- Twenty-one percent of the inboard motorboats reported by respondent/owners are 14 to 20 feet long, 36 percent are 21 to 28 feet, and 44 percent are 29 or more feet long.
- Twenty-eight percent of inboard/outboard motorboats are 14 to 20 feet, 66 percent are 21 to 28 feet, and six percent are 29 or more feet.
- Seventy-three percent of outboard motorboats are 14 to 20 feet, 23 percent are 21 to 28 feet, and four percent are 29 or more feet.
- Six percent of powered sailboats are 14 to 20 feet, 51 percent are 21 to 28 feet, and 43 percent are 29 or more feet.
- Thirty-two percent of pontoon boats are 14 to 20 feet and 68 percent are 21 to 28 feet.

## Boat usage

Nearly two-thirds of the boat owners surveyed said they use their boats either “all” or “most” of the time (43 percent “all” and 22 percent “most”), with 30 percent saying they use their boat “half the time” or “some of the time” (9 percent “half” and 21 percent “some”). Five percent said they “seldom” use their boat.

- Sixty-eight percent of Michigan boaters use their boats “all/most” of the time, which is eight points higher than the 60 percent of the Wisconsin subsample reporting the same usage.
- Older boaters and respondents with more education use their boats much more than do younger and less educated boaters.

Somewhat surprisingly, the highest “all the time” use by income is among boaters reporting incomes of \$60,000 to \$75,000 (48 percent of these respondents). Higher income groups use their boats at about the same rate as lower income groups.

Highest “all the time” use in Michigan is in the “north shore” (54 percent), followed by the interior area (43 percent) and the “south shore” area (38 percent). In Wisconsin, highest “all the time” use is in the Milwaukee County area (53 percent), with “outstate” areas using their boats “all the time” much less (27 percent).

Highest “all the time” use by boat type is 55 percent among powered sailboat owners, with pontoon boats following at 45 percent, and inboard motorboats and inboard/outboard motorboats at 44 percent each. Only thirty percent of the owners of the smallest boats (in the 14 to 20 foot range) use their boats “all the time,” with 47 percent of owners of 21 to 29 foot boats and 56 percent of owners of boats 29 feet or more using their boats “all the time,” a subset that correlates intuitively with the income subset.

Boat owners who keep their boats at a permanent or cottage waterfront locations use their boats “all the time” much more than do those who use non-waterfront locations. Likewise, 55 percent of boat owners who launch their boats from home report using their

boats “all the time,” followed by owners who launch their boats at marinas (54 percent), private launches (47 percent) and public launch sites (31 percent).

Boater/respondents who said they “seldom” use their boat on Lake Michigan or a connecting body of water were asked why they did not do so. The reason given by most of these boat owners was public access problems or the lack of mooring space (cited by 46 percent), followed by having no place to launch or keep their boat (cited by 21 percent), lower lake levels (17 percent) and the high cost of fuel (cited by 16 percent). The responses of boaters from each state was fairly similar.

## **Reported boat length**

The average length of boats reported by respondents is 24 and a half feet.

- In the Michigan subsample, 61 percent of all boats were reported as 21 to 28 feet, with 26 percent 29 feet or more and 13 percent 14 to 20 feet.
- In Wisconsin, 51 percent are 14 to 20 feet, with 35 percent 21 to 28 feet, and 14 percent 29 feet or more.

As might be expected, thirty percent of owners of 14 to 20 foot boats said they use their boats on Lake Michigan “all the time,” with 38 percent saying “some of the time” or “seldom” and 32 percent saying they use their boat on Lake Michigan waters “most” or “half” the time. Fifty-six percent of owners of boats 29 or more feet say they are used “all the time,” while 47 percent of owners of boats 21 to 28 report “all the time” usage.

Among respondents who have boats 14 to 20 feet long:

50 percent report owning outboard motorboats, 26 percent inboard/outboard motorboats, 11 percent inboard motorboats, and seven percent pontoon boats.

Among boaters with 21 to 28 foot boats:

42 percent have inboard/outboard motorboats, 24 percent powered sailboats, 13 percent inboard motorboats, 11 percent outboard motorboats and 10 percent pontoon boats.

Among owners with boats that are 29 or more feet long:

47 percent have powered sailboats, 37 percent inboard motorboats, 10 percent inboard/outboard motorboats, and four percent outboard motorboats.

The average length of current boat ownership is eight and a half years. Fifty-four percent of Wisconsin boaters and 40 percent of the Michigan subsample have owned their boats for five years or less. Nineteen percent of Michigan boaters and eight percent of the Wisconsin subsample have owned their boat for 16 or more years.

## **Location of boat storage**

Only 15 percent of Michigan boaters said they keep their boats at a marina, while 43 percent of Wisconsin respondents do so. This means that 84 percent of Michigan boaters and 55 percent of Wisconsin boaters don’t keep their boats at a marina — a significant difference between the responses from the two states.

Overall, almost half of the boater/respondents (48 percent), keep their boat at a non-waterfront residence, 20 percent at a permanent waterfront residence connected to

Lake Michigan, eight percent at a non-waterfront cottage or second home, another eight percent at a waterfront cottage or second home connected to Lake Michigan, and 16 percent were unsure on this question.

Fifty-one percent of Wisconsin respondents and 43 percent of the Michigan subsample keep their boat at a permanent non-waterfront residence.

Twenty-three percent of Wisconsin and 17 percent of Michigan boater/respondents said they keep their boats at a permanent residence on the waterfront.

Among respondents who keep their boats at a non-waterfront residence: 43 percent have inboard/outboard motorboats, 39 percent outboard motorboats, and 10 percent inboard motorboats.

A 51 percent majority of these boats are 14 to 20 feet long, 45 percent are 21 to 28 feet long, and four percent are 29 or more feet.

Among respondents who keep their boats at a permanent waterfront residence: 25 percent have pontoon boats, 25 percent outboard motorboats, 24 percent inboard/outboard motorboats, 11 percent inboard motorboats, 10 percent powered sailboats and five percent unpowered sailboats.

Forty-eight percent of these boats are 14 to 20 feet long, 40 percent are 21 to 28 feet and 12 percent are 29 or more feet.

### **Location of boat launch, use of municipal launches**

Forty-four percent of all respondents said they launch their boat from a public boat launch, 31 percent from a marina, 12 percent from their home and nine percent from a private boat launch, with one percent using a commercial boat launch. There are significant differences between the type of boat launches in Michigan and Wisconsin:

- Fifty-five percent of Wisconsin respondents and 33 percent of the Michigan subsample launch their boat from a public boat launch,
- 43 percent of Michigan boaters and 19 percent of Wisconsin respondents launch from a marina, and
- 19 percent of the Wisconsin subsample and five percent of the Michigan respondents launch from their homes.

Among the 44 percent who launch from a public boat launch: 35 percent have outboard motorboats, 34 percent inboard/outboard motorboats, 15 percent inboard motorboats, 10 percent powered sailboats and seven percent have pontoon boats.

49 percent of the boats launched are 14 to 20 feet long, 49 percent are 21 to 28 feet long and two percent are 29 or more feet long.

Among the 31 percent who launch from a marina: 41 percent have powered sailboats, 26 percent inboard/outboard motorboats, 22 percent inboard motorboats and eight percent have outboard motorboats.

50 percent of these boats are 21 to 28 feet long, 42 percent are 29 or more feet and eight percent are 14 to 20 feet.

Among respondents who launch from their home:  
 28 percent own pontoon boats, 26 percent inboard/outboard motorboats, 25 percent outboard motorboats, and 15 percent inboard motorboats.  
 49 percent of these boats are 14 to 20 feet long, 36 percent are 21 to 28 feet, and 15 are 29 or more feet.

Among respondents who launch from a private boat launch:  
 37 percent have inboard/ outboard motorboats, 30 percent powered sailboats, 14 percent outboard motorboats, and 14 percent inboard motorboats.  
 44 percent of these boats are 21 to 28 feet long, 26 percent are 29 or more feet long, and 21 percent are 14 to 20 feet long.

Most boat owners do not use the largest boat launches that were pre-coded in the survey instrument:

- In Michigan, 12 percent use the Grand Haven Municipal Ramp, three percent use Pigeon Lake, two percent Howard Schultz Park and one percent Kollen Park. The majority of these respondents, 73 percent, use some other boat launch, and nine percent are unsure of the name of the boat launch they use.
- In Wisconsin, only two percent use Manitowoc Marina, one percent each use Port Washington Marina and Grand Haven Municipal Ramp. Here, and 81 percent majority uses some other boat launch, and 15 percent are unsure of the name.

A 63 percent majority said they “always” use the same boat launch, 33 percent said they use other launches and four percent were unsure.

- Among Michigan respondents, 74 percent say they “always” use the same boat launch, while in the Wisconsin sub-sample a much lower 52 percent said the same.

Of the 33 percent who say they use other launches:

- In Michigan, nine percent said they use the Grand Haven Municipal Ramp, three percent Pigeon Lake, two percent Howard Schultz Park and one percent Kollen Park.
  - 66 percent use “other” launches, and 15 percent are unsure of what other launch they use.
- In Wisconsin, four percent said they use Manitowoc Marina and two percent Port Washington Marina
  - 77 percent use some other marina, and 17 percent are unsure of what other boat launch they use.

## Main problem for boaters

When asked what the main problem was that confronted boaters, the top problems mentioned by respondents overall was “low water levels” (cited by 29 percent), followed by “jet ski noise” (11 percent), “ignorant boaters” (10 percent), “crowded launches” (seven percent) and “temporary slips and docking space” (four percent). A variety of other problems were mentioned among another 39 percent, each by three percent or less.

- As mentioned earlier, 32 percent of Wisconsin respondents and 26 percent of the Michigan subsample mentioned low water levels as the top problem confronting boaters.

When broken down by types of boats owned, 43 percent of powered sailboat owners cited low water levels. This is followed by 35 percent of owners of inboard motorboats mentioning this problem, followed by 28 percent of inboard/outboard motorboat owners and 19 percent of outboard motorboat owners. Low water levels was cited by only three percent of pontoon boat owners.

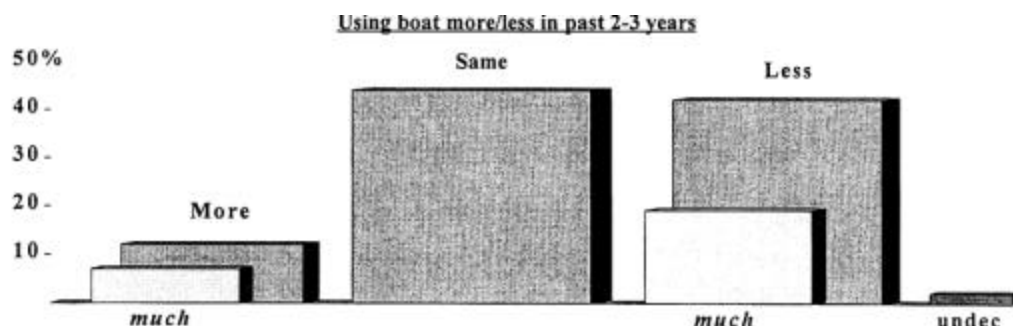
Low water levels was cited by 37 percent of respondents who “seldom” use their boats, by 36 percent of “all the time” boaters, followed by 27 percent of “most of the time” boaters, 22 percent of “half the time” boaters and 17 percent of “some of the time” boaters.

Owners of the largest boats expressed the greatest concern about low water levels, with 45 percent of owners of boats 29 feet or longer citing this problem. It was cited by 27 percent of owners of 21 to 28 foot boats, and 22 percent of the owners of the smallest boats cited it.

## Boat usage over past 2-3 years

When asked about how much they used their boat this year compared to two or three years ago, 44 percent of respondents overall said they used their boat about the same amount as before and 42 percent said less (19 percent “much” less), with 12 percent saying they used their boat more than before.

- Forty-four percent of Wisconsin respondents and 40 percent of the Michigan subsample said they used their boat less than before.



Among respondents who said they used their boat less, 33 percent have inboard/outboard motorboats, 21 percent have powered sailboats, 21 percent have inboard motorboats, and 20 percent have outboard motorboats.

### **Breakout of low water level concerns**

Concern about low water was cited as the top boating problem by 33 percent of respondents who used their boat less this year. This concern was cited by 25 percent of those who used their boats the same amount, and it was mentioned by 29 percent of boaters using their boat more this year.

When broken down by amounts spent on boat repairs attributed to low water levels, low water was mentioned as the biggest boating problem by 37 percent of respondents who said they spent more than \$250 this past boating season for repairs related to low water, by 28 percent of respondents spending \$101 to \$250, and by 25 percent of those spending \$100 or less citing this problem.

- Among respondents who said they spent more than \$500 on repairs because of low water, almost half (48 percent), said they used their boat less than two or three years ago, 50 percent of respondents who spent \$100 or less on low water repairs said they used their boat less, with respondents who said they spent \$101 to \$500 saying by less than 40 percent that they used their boat less.

### **Reasons for less, more frequent boat usage**

The top reasons given by respondents who used their boats less this year included “less free time” (cited by 45 percent of these respondents), “lower water levels” (19 percent), “bad weather” (10 percent), “bad health” (nine percent) and “less interest in boating” and “higher fuel prices” (five percent each).

- Forty-seven percent of Wisconsin respondents and 41 percent of the Michigan subsample cited less free time, while 22 percent of Michigan boaters and 18 percent of Wisconsin respondents cited low water levels.

Among respondents who said they used their boat more, 48 percent cited “more free time,” 18 percent said they “had a new boat,” 15 percent said they were “retired” and six percent each said “better fishing” and “more income.”

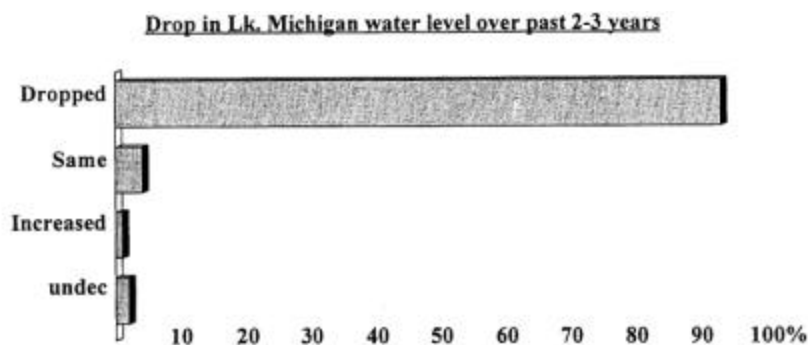
- Here, a 54 percent majority of Michigan respondents and 41 percent of the Wisconsin subsample cited more free time, a new boat was mentioned by 26 percent of Wisconsin and 11 percent of Michigan respondents, and 21 percent of the Michigan and 11 percent of the Wisconsin subsample said they used their boats more because they were retired.

Survey respondents said they used their boat an average of 31.4 days this season:

- Twenty-one percent of Wisconsin respondents and 14 percent of the Michigan subsample used their boats 41 days or more, 27 percent of Michigan and 34 percent of Wisconsin respondents used their boats one to fifteen days, and 32 percent of the Michigan and 24 percent of the Wisconsin subsample used their boats between 16 to 40 days.

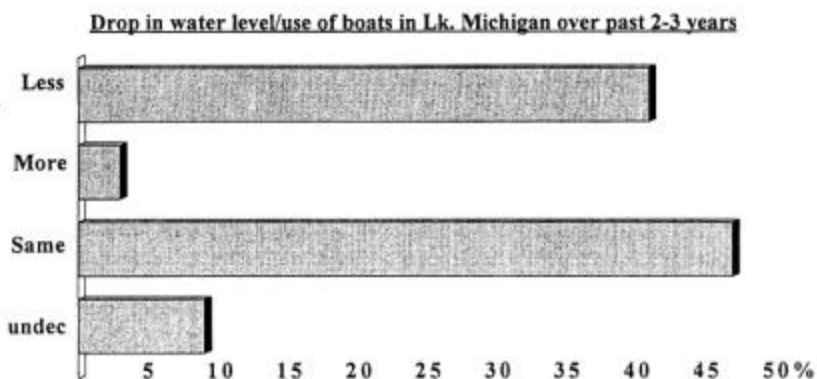
## Observation of water level drop

When respondents who had not cited low water levels as the top boat problem were specifically asked if Lake Michigan water levels have dropped, remained the same, or increased, 93 percent said “dropped.” Clearly, these boaters know that water levels have been declining.



There is no difference between the respondents of each state on this question, and in both the Michigan and Wisconsin subsample, respondents said that water levels have dropped 2.7 feet over the past two or three years.

Respondents were asked if, based on their conversations with other boaters, boaters overall are using their boats less, the same or more because of a drop in water levels. Here, 47 percent said “the same,” 41 percent said “less,” three percent “more” and nine percent were unsure.



Among Wisconsin respondents, 46 percent said boats were used less because of low water levels and 42 percent said the same, while in the Michigan subsample, 53 percent said the same and 36 percent said less.

Fifty-one percent of inboard motorboat owners said boaters are using their boats less because of low water levels, 45 percent of inboard/outboard motorboat owners felt the same way, and less than 40 percent of owners of all other types of boats said boaters are use their boats less because of low water levels.

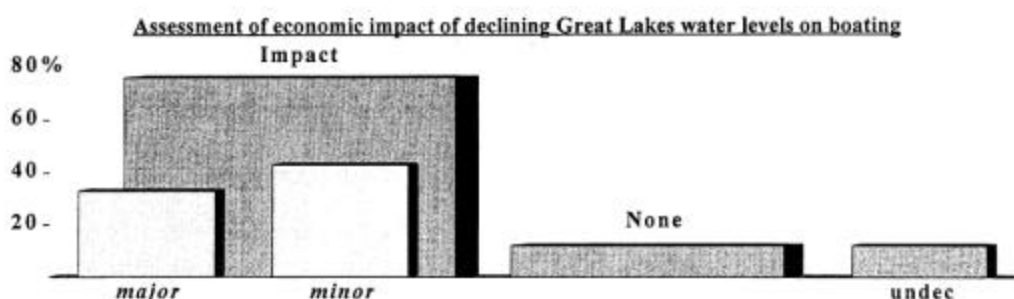
When asked if they would use their boat next year more, less or about the same, 53 percent said “the same,” 38 percent said “more,” five percent said “less” and four percent were unsure. These respondents offered “having more free time” (cited by 52

percent), “better weather” (11 percent) and “retirement” and “better health” (five percent each) as the top reasons why they would be using their boat more next year.

### Impact of water level drop, problems caused

Boater/respondents were first asked to identify the biggest problems caused by lower water levels, and in a follow-up question were asked to name another significant problem. In the first asking, the top responses were: being more cautious because of rocks (mentioned by 19 percent), harder to launch their boat (17 percent), can’t get some places (14 percent) and needed boat repairs (seven percent). In the second asking, the alternative top problems mentioned were: must be cautious because of rocks (23 percent); harder to launch (10 percent); high docks, mud, weeds (nine percent each); and can’t get some places (eight percent).

A third of all respondents (33 percent), said declining water levels on the Great Lakes have had a “major” impact on boating, another 43 percent said it had a “minor” impact, 12 percent said “no impact at all” and 12 percent were unsure on this question. In the Wisconsin subsample, 38 percent said “major impact,” with 28 percent of Michigan respondents sharing that view.



Thirty-six percent of “all the time” boater/respondents said declining water levels have had a major impact on boating, as did 39 percent of “most of the time” boaters, 46 percent of “seldom” boaters, 26 percent of “some of the time” boaters and 20 percent of “half the time” boaters.

Forty percent of boaters owning the largest boats (29 feet or more), 35 percent of owners with the smallest boats (14 to 20 feet) and 30 percent owners of 21 to 28 foot boats, said declining water levels have had a major economic impact on boating.

Forty-nine percent of respondents who said they spend over \$100 per day on food and beverages while boating, and 40 percent of boaters spending \$51 to \$100 per day, said declining water levels have had a “major” economic impact on boating. Thirty-three percent of boaters spending \$26 to \$50 per day (the survey average) said “major” economic impact, as did 25 percent of respondents spending \$25 or less per day.

Respondents who said declining water levels have had a “major” or a “minor” impact said the top problems caused by low water levels included: “an overall drop in boating” (cited by 19 percent of these respondents), “tourism would suffer” (13 percent), “it would close some marinas” (10 percent) and “there would be less commercial fishing” (10 percent).



## **Boating finances**

Respondents reported boaters having on average 3.85 people traveling with them on an average boat trip, including family and friends, and they say they spend a mean amount of \$57.45 on food, beverages and other items purchased on an average trip. There were no significant differences between Michigan and Wisconsin boaters on daily cost. Respondents also said they spend almost \$1,300 per season for fuel, dock fees and boat repairs.

When asked how much they have spent on repairs that can be attributed specifically to low water levels, such as propeller damage over the past few years, respondents gave a mean amount of \$218. The nine percent who said they had to seek alternative berthing because launches were not accessible said they had to spend almost \$800 for alternative berthing. The percent who said they had to use public marinas because a shoreline private dock was too shallow said this cost them about \$145 over the past few years.

## **Impact of future water level drops:**

### **1 foot**

Two-thirds of the respondents overall (67 percent) said a water level drop of about a foot over the next few years would have a “major” impact on boating, 22 percent said it would have a “minor” impact, eight percent said “no impact at all” and three percent were unsure.

- Respondents saying a one-foot drop would have an impact said it would limit their access to ports (cited by 21 percent of these respondents), it would make it difficult to launch (16 percent), there would be an overall drop in boating (13 percent), and it would close some marinas (eight percent).

More than a third of respondents (34 percent) said a drop in water levels of a foot would force them to seek alternative launch sites, with 59 percent saying it would not be a problem and seven percent unsure. Thirty-seven percent of Wisconsin respondents and 31 percent of the Michigan subsample said they would have to seek alternative launch sites.

Forty-nine percent of those saying they would have to seek alternative launch sites said they were unsure of which boat launch they would use.

- Among Michigan respondents, nine percent said they would use Grand Haven Municipal Ramp, two percent said they would use Kollen Park, one percent would use Pigeon Lake, and 39 percent would use other boat launches.
- In the Wisconsin subsample, 58 percent were unsure of which boat launch they would use, three percent said they would use Port Washington Marina, and 39 percent said they would use other launch sites.

### **2 feet**

An 86 percent majority said there would be a “major” impact on boating if water levels dropped by two feet below current levels, nine percent said it would have a “minor” impact, only three percent said it would have “no impact at all”, and two percent were unsure.

- Twenty percent of those saying a two-foot drop would have an impact said it would limit access to ports, 16 percent said it would cause an overall drop in boating, 14 percent said it would make it difficult to launch, and 13 percent said it would close some marinas.

Almost half of all respondents (48 percent), said they would have to seek alternative launch sites, 43 percent said they would not have a problem, and nine percent were unsure.

- In the Michigan subsample, 63 percent of these respondents were unsure of which launch site they would use, four percent said they would use Grand Haven Municipal Ramp, one percent each would use Howard Schultz Park and Kollen Park and 31 percent said they would use other sites.
- Among Wisconsin respondents, an identical 63 percent said they were unsure of which site they would use, two percent each would use Manitowoc Marina and Port Washington, while 33 percent would use some other site.

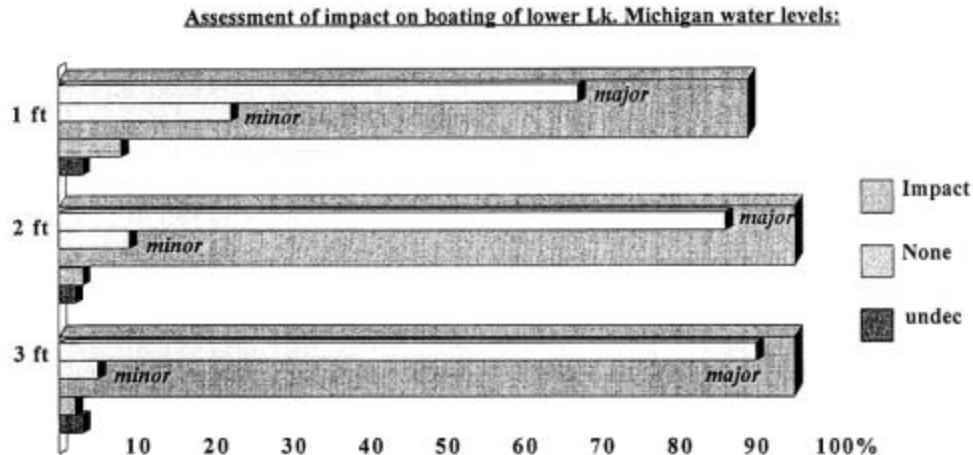
### 3 feet

If water levels dropped three feet below current levels — equal to the lowest levels recorded in the past couple of hundred years and 1.7 feet lower than the lowest levels recorded in 1964 — a 90 percent majority said it would have a “major” impact, five percent said a “minor” impact, two percent said “no impact” and three percent were unsure.

The top problem identified by respondents saying such a huge drop would have an impact was an overall drop in boating (cited by 24 percent of these respondents), followed by limited access to ports (cited by 18 percent), some marinas closed (12 percent), difficult launching (10 percent) and less commercial shipping (six percent).

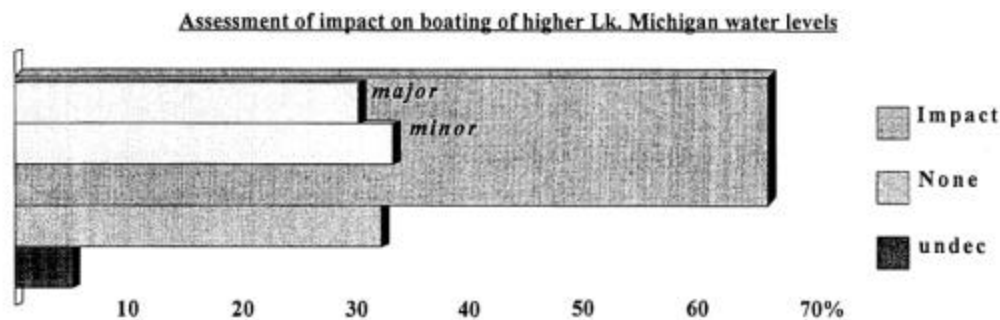
A 55 percent majority said that given a three-foot drop, they would have to seek alternative launch sites, with only 31 percent saying it would not be a problem and 14 percent unsure or citing other responses.

- In the Michigan subsample, 68 percent of these respondents were unsure of which alternative site to use, two percent each would use Kollen Park and Grand Haven, one percent would use Howard Schultz, and 27 percent would use other sites.
- Among Wisconsin respondents, 75 percent were unsure of which site to use, two percent would use Manitowoc Marina, and 23 percent would use other sites.



### Impact of higher water levels

When asked about the opposite problem — high water levels of about a foot higher than the previously recorded high levels in 1986, or about five feet higher than this past summer — 30 percent of respondents overall said this would have a “major” impact, 33 percent a “minor” impact, 32 percent “no real impact at all” and five percent unsure.



- Among respondents saying that there would be an impact, at 23 percent said the main problem would be water over the docks, 21 percent cited beach erosion, 19 percent cited the cost of raising the docks and 15 percent mentioned more boat traffic.
- Here, only eight percent said they would have to seek alternative boat launch sites, 88 percent said it would not be a problem and four percent were unsure.
  - In the Michigan subsample, a 58 percent majority of these respondents were unsure of which alternative site they would use, and 42 percent cited launch sites other than those that were pre-coded into the responses.
  - Among Wisconsin respondents, a 75 percent majority of these respondents was unsure of what alternative site they would use and 25 percent cited launch sites other than those pre-coded.

## Demographic profile of boat owner/respondents

- Employment status:
  - Two-thirds of respondents are currently employed, 31 percent are retired, one percent unemployed, one percent homemakers, and one percent other occupations.
  - In the Wisconsin subsample, 69 percent are employed and 29 percent are retired, while among Michigan respondents 63 percent are employed and 33 percent are retired.
- Age:
  - Only 13 percent are age 40 or under, 23 percent are age 41 to 49, 22 percent are age 50 to 55, 21 percent are age 56 and over, and 19 percent age 56 to 64.
  - Eleven percent of Michigan subsample respondents and 17 percent of their Wisconsin counterparts are age 40 or under; 47 percent of the Michigan and 38 percent of the Wisconsin subsample are age 56 and over; and 40 percent of Michigan and 43 percent of Wisconsin respondents are age 41 to 55.
- Education
  - Forty-five percent are college graduates or have post-graduate school degrees, 24 percent have some college, 24 percent are high school graduates, three percent non-college post high school technical training, and only four percent have less than a high school education.
  - Forty-nine percent of the Michigan subsample and 42 percent of Wisconsin respondents have a college education or more; 27 percent of Michigan and 28 percent of Wisconsin boaters have a high school education or less, and 25 percent of Michigan and 29 percent of Wisconsin boaters have some college or technical post high school training.
- Gender
  - A 92 percent majority of boater/respondents were men, including 90 percent of the Wisconsin subsample and 93 percent of their Michigan counterparts.
- Income
  - Only 12 percent overall reported a household income of less than \$45,000 per year, with 34 percent reporting incomes of more than \$75,000, and 31 percent of \$45,000 to \$75,000.
  - Eleven percent of the Michigan respondents and 14 percent of the Wisconsin subsample reported incomes under \$45,000, with 33 percent of the Michigan and 36 percent of the Wisconsin respondents reporting incomes over \$75,000.

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